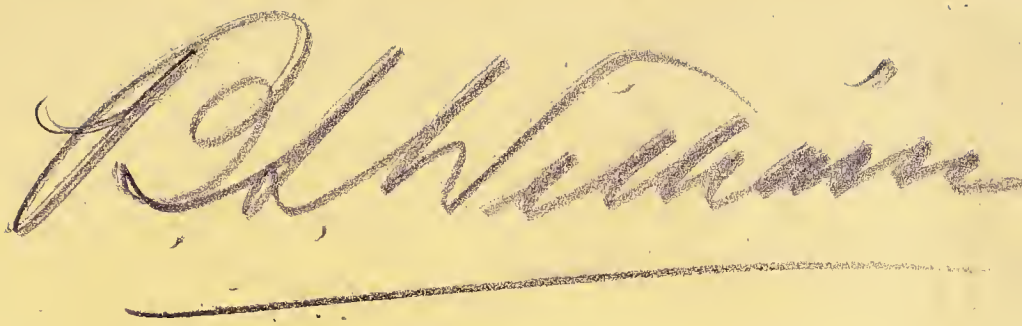

ON THE

MANAGEMENT OF HEALTH

FROM

INFANCY TO ADULT AGE.

CHESTERFIELD : PRINTED BY C. GALLIMORE.

LETTERS

ON THE

MORE EVIDENT CHANGES

WHICH THE

BODY UNDERGOES,

AND THE

MANAGEMENT OF HEALTH

FROM

INFANCY TO ADULT AGE,

BY C. BLACK, M.D.

MEMBER OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND, ETC.

ADDRESSED TO THE MEMBERS OF THE MEDICAL PROFESSION AND THE EDUCATED PUBLIC.

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TO

COLONEL THOMAS POWELL,

OF

HARDWICKE COURT, NEAR HAY,

DEPUTY LIEUTENANT AND MAGISTRATE

FOR

THE COUNTY OF HEREFORD,

THIS LITTLE WORK IS INSCRIBED, AS A TESTIMONY OF AFFECTIONATE REGARD FOR THE MANY KINDNESSES RECEIVED AT HIS HANDS,

BY HIS

SINCERE FRIEND AND GRATEFUL SERVANT,

THE AUTHOR.

PREFACE.

THE following pages were originally intended to be delivered as lectures; but circumstances having conspired to induce me to alter that determination, I now present them to the public in the form of letters. In doing this it is necessary to remark, that they do not profess to form a treatise on diet and regimen; but that these subjects are only so far considered as they immediately apply to the preservation of health. It will, therefore, be seen that *minutiæ* have not engaged my attention, and that I have, as far as possible, aimed at general principles, which, if duly observed, will, I venture to assert, be found amply sufficient to guide us in the management of health.

Such, indeed, is the flexibility of the human system, that it does not require very minute and exact laws to be laid down for its government, but certain general ones to be prominently set forth, up to which it is absolutely necessary, for its well being, that every individual should act. Thus, as an example of my meaning, when I insist on the importance and value of *active exercise,* I deem it unnecessary to describe or recommend the particular kinds, inasmuch as these, despite of whatever may be written or said, will almost invariably be determined by the particular inclination and physical powers of every individual. But having stated and explained the fact, I leave it to the good sense of my reader to carry it out in the manner which his own feelings and physical capabilities best direct ; and I imagine, that by so doing, the absence of any severe restrictions will conduce more to the end desired than the imposition of closely studied rules and minutely penned regulations.

As regards the style, I have endeavoured to

adapt it to the capacities of a mixed and an intelligent class of readers, whose time and patience I have been anxious not to exhaust by minute details, which at best could be of but very little moment. Condensation has, therefore, been a principal object; but how far I have in this, and other respects, accomplished my task, I presume not to aver, but humbly leave for a candid and an intelligent public to determine.

C. B.

CHESTERFIELD,
March 21*st*, 1846.

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LETTER I.

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The human body is composed of a great number of structures and organs, the actions of which are separate and peculiar, yet all tend to a certain and definite end. So long as these functions bear a corresponding ratio to each other, health may be said to be present; but as soon as one of them becomes either excessive or weak, no longer is the natural balance of action maintained, and disease is consequently set up.

Health, then, may be defined to be the harmonious action of every organ of the body; life, as the maintenance of the vital powers against the things which constantly tend to destroy them; whilst the combat between the egoistical and planetary powers, constitutes disease.

To the first of these, viewed in connexion with the means which are best calculated to preserve it, my attention has been directed for some time, and as the subject is one of vital importance to every

individual irrespectively of age, sex, rank, or any distinction, no greater incentive than this is required to ensure your undivided attention.

Without good health life cannot be enjoyed ; and, as I believe man to have been formed, by an All-wise Omnipotent, for happiness and restrictive enjoyments in this life, the wilful destruction of health, which is too frequently the case, renders in some measure nugatory the design of Providence, and leads to pain, disease, and premature death.

To the invalid, the hopes—the pleasures—the interests of the world are but as nought in comparison with sound health ; yet how few, who are in the enjoyment of the latter, take the means to preserve it, and to conduct themselves with ease and comfort to mature old age !

The frailty of human nature—the waywardness of imagination—the caprice of fancy—the allurements and seductive influence of the world, all tend to prostrate our better judgment—to enslave the passions—to overthrow rules and regulations by which we ought to be governed—to sap the foundation of our very system, and to shorten considerably our natural term of existence.

Many, indeed, there are who unintentionally and unknowingly depress the vital energies of their system, by means which, to them, may appear to have no injurious tendency ; but which are nevertheless calculated to undermine the constitution, and ultimately to break the powers of the body. To such persons I would that I could be of benefit, by pointing out to

them the means which they should adopt in the preservation of their health, and by convincing them of the really few and simple wants of nature.

It is only by the flexibility of our system that so many diversities of living can be tolerated; for truly the indications of nature do not point to such things. Let me, then, impress on your memory the fact, that sound health is most compatible with the plainest food, provided such food contain a sufficiency of alimentary principles. Of these principles I shall hereafter speak; but, at present, I direct your attention to the fact, that nature seldom acts by secret and unknown laws; but that most of her steps follow each other in regular gradation, and are evident in their cause to a reflective mind.

These, in both the animal and vegetable Kingdoms, require to be carefully watched, and not to be interrupted or in the slightest degree disturbed, lest the individual come to serious harm. So nicely, indeed, are the functions of the animal system balanced—so great is the sympathy that exists between the different organs, that no function can be suspended, even for a short time, without the whole chain of organs feeling a corresponding impression, and, in many instances, without danger to life. Hence it is evident that, for the maintenance of sound health, the animal machine should be perfect, and all its organs competent to perform their proper functions.

When, however, we take into consideration the numerous causes that constantly tend to destroy the one or pervert the other,—when we reflect on the great

cycle of changes which the system undergoes in different periods of life, we cannot wonder that some of the functions occasionally lose their equivalent ratio, and that the system falls into a state of disease. Much may nevertheless be done by controlling these actions—by checking those which are inordinate, and promoting those that are tardy, so that a balance of action shall be maintained. In this, consists the art of preserving health; but, in doing this, many things are to be considered which materially influence the system, such as age, sex, constitution, food, drink, air, exercise, cleanliness, clothing, &c.

In reference to the functions of the animal economy, by which man lives and flourishes, they are divided into Vital, Natural, and Animal.

Vital functions comprehend the action of the brain and nerves, respiration, and circulation. These are so necessary to the well being of the individual, that they cannot be interrupted or suspended even for a few moments, without imminent danger to life.

Natural functions, on the other hand, point to digestion, secretion, and excretion, and these may be suspended for a short time without the induction of any untoward result.

To animal functions are referred every sense and voluntary motion, by which we are enabled to take cognizance of the external world, and to enjoy the pleasures of the earth by which we are surrounded.

As these actions are greatly modified by age, it will be necessary, for the proper elucidation of my subject, to divide life into so many phases or epochs—to trace

the more evident changes which the body undergoes during these periods,—to point out the peculiar susceptibilities of each, and the necessary indications to be observed.

The division which to me appears to be the most simple and comprehensive, regards life as consisting of six epochs—namely, infancy, childhood, boyhood, adolescence, manhood, and old age.

Each of these, with the exception of the last, I shall review in the order above stated, and first with respect to—

Infancy:—This term is derived from the Latin *infantia*, signifying an absence or a want of speech. It extends from the period of birth to the completion of the second year. Founding, however, my division on the changes which the system undergoes in its development, this period may not improperly be subdivided into two epochs, the former of which commences at birth, and extends to the beginning of the first dentition, about the sixth or seventh month—the latter from that time to the completion of the first dentition, which usually takes place about the end of the second year.

1st. Epoch:—At this time all the structures are being developed, especially the bones, brain, nerves, and muscles; while several functions, of which it is not necessary here to speak, have not yet appeared. The organization of these parts not being complete, life is chiefly vegetative, and the movements of the infant, automatic. The brain is no firmer than jelly; hence the higher faculties of the mind are absent.

The bones are remarkably soft and the muscles weak; hence the inability to escape from any impending danger, and the necessity for a mother's care.

As development proceeds, the brain becomes firmer, the bones harder, and the muscles stronger; and these lead to important results—namely, the gradual evolution of the mind—the ability to sustain the body on the feet—to transport it from place to place, and the elevation to a state of independence. From the incomplete development of the various organs, the quantity of blood which they receive, is great, and the circulation rapid, for the purpose of perfecting their organization, and thereby adapting the infant to its present state of existence. Nutrition is therefore, exceedingly active, and the irritability of parts very great. This latter condition in the infant would seem to be especially necessary, as a protective power, to warn us of external impressions acting on the skin, lungs, and digestive organs, of which it is remarkably susceptible. This, then, points to the necessity for the surface of the body being well protected from cold, and of the food being duly regulated with respect to both quantity and quality. While, however, the surface of the body should be warmly clothed, the head should be kept cool; for, at this period, the circulation through the brain is very active, which, if increased by warmth, might lead to inflammation of that organ or of its coverings, and thereby to serous effusion, deranged structure, and death. In every organ the disposition to excited action is so great that it requires the utmost attention to ward off dis-

ease, and to conduct the infant to the second epoch of life.

The slightest derangement in the nurse's milk, or the reception of any unsuitable *ingesta* into the stomach, not unfrequently gives rise to inflammation of the mucous membrane of the bowels, on which a similar affection of the brain or its coverings and eruptions on the skin may supervene. We thus see the connexion, or rather the sympathy, which these organs have with each other; but here I must step aside to explain the meaning of the term *mucous membrane,* of which I have just made mention.

By this is to be understood that structure which lines every channel that opens on the external susface of the body, and which is every where continuous with the skin, of which it may justly be regarded as a modification. It exercises one general function, by which a quantity of *mucus* is thrown out, to sheath its surface, and to protect it from irritating substances. Of the impression of these as well as of *stimuli,* it is remarkably susceptible, on which account they should, as far as possible, be avoided. For the like reason, and owing to the activity of the nervous system, medicines, and especially *narcotics* and irritating stimulants, which act on the nervous *centres,* have great influence. Hence the injurious effects of Opium and its preparations, which increase vascular action—produce congestion of the brain, which not unfrequently merges into slow inflammation,—that leads on to partial disorganization and consequent semi-idiocy. Let every mother bear this fact in remembrance, and

discontinue the occasional use of potent drugs, which even the Physician employs with the greatest care.

If aperients are required, they should be mild and inirritating, of which class Magnesia, Manna, and Castor Oil may be particularized.

The chief indications of treatment, during this period, are—exposure to a mild salubrious air, frequent ablutions with first warm, afterwards tepid, then cold water, followed by friction—attention to diet and clothing.

Of the last two mentioned agents I shall here speak, as far as they are applicable to the present age; reserving the discussion of the preceding for a subsequent letter.

In reference, then, to the aliment of the infant, if we follow the indications of nature, and take into consideration the absence of teeth, which points out the inability there is to masticate any substance, we are inductively led to the conclusion that, at this period, the food ought to be of a fluid consistence, and, therefore, the milk of the mother should form the infant's sole support during the first six months of its existence. We ought, however, to be particularly careful to ascertain that the mother is in good health, and that her mode of living is compatible with the health of the infant. For this purpose she should be subjected to a careful examination—every organ must be scrutinizingly passed in review, to detect any lurking or hereditary predisposition to disease—the habits are to be inquired into—and her milk subjected to microscopical examination.

If this be healthy, it will be found, by the aid of the microscope, to consist of a number of globules, which are round, isolated, and roll freely on each other in a serous fluid; whereas, if it be diseased, they will be indistinct and coagulated.

Should our inquiry detect the latter condition of the milk, no attempt should be made by the mother to nurse her infant, as her nourishment would inevitably lead to disorder of the digestive organs, and thereby to imperfect nutrition of the infant. A young and healthy nurse should, therefore, be substituted, or the milk of some of the inferior animals given at proper intervals. If the former *desideratum* can be attained, let it have the preference, on the ascertained fact—that not more than one in six or seven, who are deprived of that kind of nourishment which nature evidently intended for this epoch, arrives at the more advanced periods of life. This is an important fact, and one which ought to have great weight with every mother whose condition demands, and whose means can supply a substitute. If, however, she fail in this object, let her resort to the milk of some of the lower animals, the composition of some of which I shall here contrast with that of her own sex and species.—

Constituents.	MILK OF THE				
	Woman.	Ass.	Cow.	Goat.	Ewe.
Caseum ..	1,52	1,82	4,48	4,02	4,50
Butter	3,55	0,11	3,13	3,32	4,20
Sugar of Milk	6,50	6,08	4,77	5,28	5,00
Various Salts	0,45	0,34	0,60	0,58	0,68
Water	87,98	91,65	87,02	86,80	85,62
	100,00	100,00	100,00	100,00	100,00
Solid Sub. ..	12,02	8,35	12,98	13,20	14,38

Now, the nutritive principles of milk are, independently of water, caseum, butter, and sugar of milk, to which may be added phosphate of lime, which is certainly necessary for the development of the osseous system. By this statement we are led to Prout's division of alimentary principles into the Albuminous, Oleaginous, and Saccharine.

Under the first of these divisions we include fibrine, albumen, caseum, gelatine, gluten, and osmazome, all of which, with the single exception of gluten, are derived from the animal kingdom, in consequence of which they have been termed—animal aliments.

To the second, or oleaginous division, we refer all substances denominated fats, fixed oils, and butters, the ultimate constituents of which are carbon, hydrogen, and oxygen.

In the third, or saccharine division, we rank sugar, gum, vegetable jelly, starch, and lignin, all of which are derived from the vegetable kingdom, and consist of carbon, hydrogen, and oxygen,—the last two, except in pectin or vegetable jelly, in the proportions to form water.

All substances, therefore, which contain these principles are, provided no noxious principle is present in them, nutritious and fit for food; but it does not follow, as a necessary corollary, that they are applicable to every age. In the form of compound aliments, which comprise animals and vegetables, they are inadmissible at this period, and can only be rationally used in the form which I have before laid down—namely, that of milk. Now, the quantity of

nutritive matter contained in this fluid, is not only subject to variation with the species and the individual, but with the same individual under different circumstances. The quantity and quality also undergo similar variations by constitution—age—food—medicine—mental emotion—and disease. Thus an animal, to which vegetable aliment alone was given, yielded ascescent and spontaneously coagulable milk, which afterwards became alkaline, and did not coagulate on the substitution of animal for vegetable food.

In the opinion of Cullen, nurses who live entirely, or for the most part, on vegetable aliment, afford a greater quantity of milk, and that too, of a more proper quality, than those who subsist chiefly on animal food. This opinion derives great weight from the acknowledged talents and high standing of its promulgator, as well as from its being deduced from the observations of fifty years. Were I, then, called on to diet a nurse, I should, for the above reasons, advise that two-thirds of her food consist of vegetables, which, according to their peculiar properties, are found by experiment to influence greatly the secretion, taste, odour, and even colour of the milk. Thus by the use of bitters, such as wormwood, the taste is greatly modified; by alliaceous and cruciferous plants the odour is affected; while saffron or madder impart to it respectively a yellowish or reddish tinge. It is further known that infants may be salivated, purged, or narcotised, by medicines having these tendencies administered only to the nurse.

With these facts before us, mothers and nurses

cannot be too careful, in a dietetical point of view, inasmuch as on their health depends that of the infant whom they support. The health of both being so closely connected, and that of the one so entirely dependant on the state of the other, both parties should occupy large and well ventilated apartments during the period of lactation, which ought not to extend beyond the tenth, or at latest, the twelfth month, inasmuch, as after this period, the milk becomes poor and innutritious, and consequently induces a weak and debilitated state of the body. If it be in the summer season, both parties should take regular exercise in the open air, by which the circulation is accelerated—the number of respirations increased—the blood more perfectly oxygenated—the vitality of parts augmented—and the health of the digestive organs duly maintained.

I might here explain to you the mode in which air promotes the functions and health of the body, by physiological reference to circulation and respiration; but these subjects will best be considered under manhood, in treating of which I shall bring them prominently before your notice.

It suffices, then, for the present to say that fresh air, at proper seasons, is requisite for the health and vigour of the infantile constitution, which should nevertheless, be protected from every vicissitude of climate.

Infants do not possess the temperature of adult age, nor yet the power of generating heat to the same degree; therefore, it is evident that their clothing should be of the warmest materials, and that every part of

the body should be protected from the influence of cold. For this purpose their dress should consist of imperfect conductors of caloric, which prevent the heat of the body from being too rapidly withdrawn by the surrounding air, and thus keep up a vigorous *capillary** circulation through the skin.

Silks, wools, cottons, downs, and furs, possess this property in a high degree, as will be seen by the following table, in which is shown the time a Thermometer took to cool 135° when surrounded by various substances, of which that is the worst conductor which took the longest time to cool:—

	NUMBER OF SECONDS.
Spun Silk	917
Fine Lint	1,032
Cotton Wool	1,046
Sheep's Wool	1,118
Raw Silk	1,284
Beaver's Fur	1,296
Eider Down	1,305
Hare's Fur	1,315

In air the Thermometer fell through the same range of temperature in 576 seconds, from which fact you will be enabled to estimate the relative warmth of the above materials. Of such textures the infant's dress should be made, and this, too, sufficiently loose to offer no restraint to the free motion of the limbs, which certainly conduces to the health of the child.

With the same view cleanliness is to be strictly ob-

* Refers to the smallest blood-vessels, which are called capillaries, from *capillus*, a hair. They form a continuous channel between the termination of the arteries and the commencement of the veins, and are the seat of many changes during both health and disease.

served by frequent ablutions, which effectually cleanse the skin, and tend to maintain a healthy proportion of the cutaneous secretion. But to this I shall again recur.

With the approach of sleep our anxieties and endeavours to preserve the health of the infant do not terminate; but they, on the contrary, accompany us to its dormitory and to the arrangement of its bed, on which it is necessary that the silent hours of night should be passed in sound and refreshing sleep. To effect this, an elevated situation, with free access to fresh air and the sun's rays, should be chosen—the bed-room should be large and well ventilated, nor should the bed be surrounded by more curtains than are absolutely necessary to protect from currents of air. When a country residence can be procured, this will be far preferable to the town, and, in the choice of a situation, it is well to observe, that a residence in the neighbourhood of marshes and stagnant waters is to be strictly avoided. If the house be surrounded by trees at some little distance, it will be rendered more healthy, from the influence which they exert in purifying the air; but should it be overhung by them, they will act injuriously, by keeping up a constant humidity, which becomes the source of frequent *catarrhs**.

By such means, then, ought we to endeavour to preserve the health of the infant during the first epoch of its existence, and to conduct it to that which immediately follows, the changes, peculiarities, and susceptibilities of which I now proceed to trace.

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* Catarrh—the technical term for a "common cold."

LETTER II.

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INFANCY CONTINUED.

2nd. Epoch :—During this period the natural changes which are taking place in the first epoch, continue, and the functions of external relation appear. The faculty of speech is acquired—the organs of locomotion are competent to perform their functions—and the manifestations of mind begin to show themselves. Thus perception is more perfect and the instinctive desires more active, which, together with the expression of the countenance, the state of the lips, tongue, gums, and other organs, afford important indications to the Physician, of the nature and extent of disease. The composition of the body is now somewhat different, inasmuch as it contains less water and gelatine, and more fibrine and phosphate of lime. Hence the increased strength of the muscles and the greater hardness of the bones.

Much, however, yet remains to be done; but nature is generally competent to her task; and, as the stream of life glides on, constant mutation pervades every structure, by which gelatine gradually becomes less and less, and the phosphate of lime accumulates. While such important changes as these are going forward, no wonder that the sensibility of the nervous system and mucous surfaces is great, and that they

feel acutely the impression of cold, moisture, contagious and infectious miasms, errors of diet, and regimen.

But now comes an important crisis, which is to test the acquired strength of the body, as well as the innate powers of the constitution. The teeth begin to make their appearance, and disorder of the system, in proportion to the health and strength of the infant, is usually set up. An intolerable itching and irritation pervade the gums, which latter extends to the salivary apparatus, the function of which is excited, and an increased flow of saliva is the result.

If this irritation be not allayed, the nervous system becomes affected—febrile commotion, convulsions, and inflammation of the brain and mucous tracts are induced, which too often defy the utmost efforts of the Physician, and quickly extinguish the powers of life.

Its effects, however, do not stop here;—digestion is impaired, nutrition is consequently defective, and hence the occurrence of thrush, scrofula, remittent fever, rickets, *marasmus*,* *tubercles*,† *and exanthematous* ‡ disorders. Still the vital energies are more developed, and the functions more generally perfect, which combat the increased disposition to disease, and limit considerably its disorganizing power. Notwithstanding this, infectious and exanthematous disorders prevail, the glands, and especially those of the chest

* Marasmus,—Wasting.

† Tubercles,—A deposition of a peculiar matter, which takes place in different organs, and which is the characteristic of scrofula.

‡ Exanthematous disorders—scarlatina, measles, erysipelas, erythema, nettle and rose-rash.

and abdomen, are prone to disease, while the bowels become infested by worms. Thus is the infant system liable to diseases, which, in their march, may either wither by quick and ruthless step, or waste by slow and almost imperceptible decay.

To prevent such unfortunate circumstances, it behoves us to consider well the individual constitution, peculiarities, and idiosyncrasy, and to bring our best *therapeutical** and hygienic agents to bear upon them. The head must, therefore, be kept cool, as in the former epoch, to ward off vascular excitement of the brain, to which there is a remarkable disposition.—*Anodynes*† are now less injurious than before, and, in some instances, they are required to soothe the nervous system when irritable either from dentition, the effects of former remedies, or previous disease. Although these remedies may now be employed in proportion to the severity of the affections that require them, opium and its preparations cannot be too studiously avoided, in consequence of their effects on the cerebral circulation as before mentioned. In some instances we cannot well dispense with their use, but in many, in which they are now employed, the substitution of henbane and other solanaceous plants would undoubtedly produce the desired effect.

Great attention should be paid to the state of the gums, which, if red or swollen, with any marked disturbance of the system, ought to be freely scarified. In advising this remedy, I am well aware that I have to

* Therapeutical,—relating to the treatment of disease.

† Anodynes,—medicines which relieve pain.

combat the prejudices of many mothers, who maintain that the cicatrix produced by the healing of a scarified gum, renders more difficult the process of dentition. To some extent I am willing to admit the force of this objection; but, if we refer to the manner in which the teeth appear in the gums—to the structures through which they have to protrude—the vascularity of these—and the intimate nervous connexion which they have with the brain, we have far more powerful reasons why we should resort to this expedient when the state of the gums manifestly requires it.* I would, therefore, urge on you the necessity for this trifling operation, the insignificance of which bears no comparison with the advantages gained thereby. Under other circumstances it will be sufficient to allow the infant an ivory, or a coral, or gold ring, which the itching of the gums induces it to carry to them, and to press it between them, which not only relieves the irritation, but hastens materially the process of dentition.

It is the opinion of some writers that weaning should not commence until four teeth have protruded through the gums, which, as a general rule, may, perhaps, be adopted; but it were manifestly injudicious to limit, in every case, the period of lactation to this occurrence, inasmuch as ill health, on the part of the mother, might render this step advisable even during the preceding epoch; while late teething, on the part

* If the teeth are not ready to come through the gums, and if the system is suffering, I prefer lancing the side of the gums at the seat of irritation, by which means the congestion of the parts is relieved, and the resulting cicatrix does not interfere with the subsequent progress of dentition.

of the infant, might prolong lactation until the milk afforded by the mother, had become innutritious and injurious. It is, therefore, necessary that it should take place before the milk has undergone any change in composition or quality, and while the infant is as yet healthy and vigorous. The tenth, or even the twelfth month will secure these advantages, at which period weaning should certainly have taken place.

Presuming, then, that this process has commenced, and that the infant has cut several teeth, a very small proportion of animal food may be occasionally allowed it as soon as it can masticate; but great attention is necessary, as to the frequency of its repetition, lest the digestive organs be oppressed, and indisposition lighted up. At first, animal food twice or thrice a week will be sufficiently often; but, towards the close of this epoch, a very small quantity may be given every day, and, by so doing, it will contribute to the health and vigour of the infant. It is certainly never required before the completion of the first year, up to which period wheaten bread steeped in milk which has been sweetened with a little sugar, or milk with rice, sago, salep, arrow-root, or tapioca, together with that of the mother, is all that is necessary. From the sixth month these amylaceous substances may be given in addition to the natural aliment of the infant; but always with due precaution and in small quantities at first, which require to be gradually increased in bulk, as well as in frequency, as weaning approaches. With this assertion, however, let us not rest satisfied; but endeavour to show why such

and such substances are most befitting this tender age. In attempting this, we must recall to our memory the important truth of the great excitability of the infant system, and of the disposition of the mucous surfaces to inflammatory action, which point to the necessity for a nutritious, easily digestible, and unstimulating diet. Are these substances then really so? The answer is in the affirmative; for, if we subject them to analysis, their constituents are found to be principally starch, together with gluten, sugar, and gum, which, you will remember, are ranked in the Saccharine and Albuminous Divisions of alimentary principles, and are, therefore, capable of assimilation, and of becoming a part and parcel of the body. As regards arrow-root, it is considered by Prout to be a low variety of starch, which is analogous in its composition to the low sugar of honey; while that derived from wheat he regards as the most perfect form of starch, which is analogous to sugar-candy. With this and the other previously named alimentary principles, no stimulating, or otherwise noxious substance is associated in the above articles, from which and their mean time of digestion, as expressed below, are inferred their great suitability as food, and their peculiar adaptation to the infant system.

Articles of Diet.	Mode of Preparation.	Time required for Digestion.	
		H.	M.
Rice	Boiled	1	..
Sago	Ditto	1	45
Arrow-root ..	Ditto	1	45
Tapioca	Ditto	2	..

On the same principle as we now administer bland and unstimulating food, so also must we exhibit medicines, which, as in the preceding epoch, generally require to be of a mild and cooling nature.

Blisters, too, should be employed with the greatest care, and especially in inflammation of the lungs, when the air-tubes are obstructed—their functions interrupted, and the energies and vital resistance of the system exhausted. But on this point I need not further instruct you, as few persons would be willing to trust to their own knowledge in the treatment of such dangerous affections as inflammation of the lungs. In other respects, however, the management of your offspring, during the period in question, devolves entirely on yourselves, and the success of your guardianship will mainly depend on your knowledge by study, experience, and observation, of the peculiarities, requirements, and dependencies of your office. A just conception of these will lead you to pay as great an attention to diet, air, exercise, clothing, and sleep, in this, as was insisted on in the preceding epoch, the observations respecting which are equally applicable to the period under consideration.

As regards ablutions, the water may now be used cold, provided it be followed immediately by friction, and that be succeeded by a sensation of warmth, which is a sure indication of its beneficial action. If a chill follow its employment, discontinue the use of the cold ablutions for a short time, and employ tepid bathing until the system has acquired sufficient power

to withstand the first impression of cold water.

To accurate observation must be ascribed much of the success which is obtained in every art and in every science, and to the same thing must be referred much of the knowledge which we possess in the management of health. The anatomist, by his scalpel, lays bare the structure of organs, and, by a process of induction, determines their functions, which subsequent observation confirms. From this, by the same process of induction, he infers their susceptibilities, capabilities, and wants, and thus arrives at a correct knowledge of the habits and endowments of the individual. This information, in its application to man, may not inaptly be termed the *Science of life;* but few, indeed, there are who attain to it, and whose health is governed by the principles which it inculcates. Here, however, experience and custom lend their aid, which, together with a mother's observations, becomes the polar star to her child's fragile bark, and her prayers the breath that fans its sails. For a time it may glide smoothly over the ocean of life, but should a cloud intercept its light, and angry tempests gather around, it is in danger of being wrecked, and its passenger lost. It is then that he who treats nature according to nature's laws, becomes the pilot to the tempest-tossed bark, and though thunders roar above his head, and the lightnings wrap their vivid mantle around him, by fixed determination all danger is overcome—his importance in society is felt—and tears of heartfelt gratitude embalm his cherished name.

LETTER III.

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CHILDHOOD.

Before proceeding to the subject of my present letter, a slight recapitulation of the leading facts of my last two are necessary, in order that you may distinguish the close connexion that exists between the different epochs of existence, and view life, in its successive phases, as a connected whole. Let it, then, be remembered that, in speaking of *Infancy*, it was subdivided into two epochs, the former of which extends from the period of birth to the seventh or eighth month, the latter from that period to the completion of the second year.

In reference to the former, I spoke of it as being attended by active development of the bones, brain, nerves, and muscles; of life as being merely vegetative, and the infantile movements, automatic. I further drew your attention to the rapidity of the circulation and the large quantity of blood which is sent to the different organs, to perfect their development, and to render them competent to the performance of their functions. I next glanced at the extreme susceptibility of the skin, lungs, and digestive organs, and of the consequent necessity for proper food, air,

and clothing. I then noticed the great excitability of the nervous system, and the activity of the circulation through the brain, which pointed to the importance of preserving the head cool, and thereby warding off disease of that organ.

My next step led me to the consideration of medicines, which, owing to the excitability of the nervous system as just mentioned, ought, in reference to aperients, to be mild and inirritating. At the same time I deprecated the use of opium and its preparations, as exerting great influence over the brain and nervous *centres,* and thereby disposing to disease of those organs. Strict charge was given you, as to the aliment of the infant, which, from the absence of teeth, ought, I maintained, to be furnished exclusively by the mother, provided she be in every respect healthy. The mode of determining this point, which embraced the microscopical examination of her milk, was laid down, and a comparison instituted between it and that of some of the lower animals. From the composition of this fluid, I was led to Prout's division of alimentary principles into the Albuminous, Oleaginous, and Saccharine, an example of each of which was observed in *caseum, butter,* and *sugar of milk,* as contained in that of the human species. I thence passed to the hygienic treatment of the nurse—named the influence of constitution, food, medicine, and mental emotion on the secretion and quality of the milk—and the necessity for an almost exclusively vegetable diet.

Air and exercise subsequently fell under my notice,

and their beneficial action on the system was somewhat explained ; nor did I neglect the consideration of dress, which, owing to the comparatively low power in the infant of generating heat, ought to consist of bad conductors of caloric, such as woollens, cottons, furs, &c. The choice of a situation was afterwards noticed, and the preference given to the country ; but by no means to the neighbourhood of marshes or stagnant waters, the *malaria** arising from which is often productive of most serious diseases. As plants are the purifiers and regulators of the air which we breathe, and by which the lamp of life is supported, a house surrounded by trees at some little distance, was recommended, and with this remark, I passed on to the changes, peculiarities, and susceptibilities of the *second epoch of Infancy.*

Here I noticed the continuance of the changes occurring during the former epoch—the acquirement of speech—the increased power of the organs of locomotion—the greater perfection of instinct—and the budding of the mind into existence. The composition of the body was remarked to be now somewhat altered, and to exhibit a decrease of water and gelatine, and an increase of fibrine and phosphate of lime, to which latter substances were to be ascribed the increased strength of the muscular system, and the greater hardness of the bones. The sensibility of the nervous system and mucous surfaces was still observed to continue, and to be influenced, according

* From "mala aër" signifying bad air—a certain effluvium or emanation from marshy grounds

to the health and strength of the infant, by the process of teething. In speaking of this, I remarked, that unless the itching and irritation of the gums were relieved by proper means, febrile disturbance of the system, convulsions, inflammation of the brain or of its membranes—impaired digestion, together with scrofula, remittent fever, rickets, eruptions on the skin, diarrhœa,* and an interminable list of disorders might follow, and destroy the young and tender flower on which the light of heaven had but just dawned, and whose leaves were beginning to unfold to the enlivening influence of the orient sun. To obviate such untoward results, and to ward off vascular excitement of the brain, it was recommended that the head should be kept cold—that anodynes should be employed to allay irritation of the nervous system—avoiding, however, as far as possible, the use of opium and its preparations—that the gums, when red or swollen, should be freely scarified—and that weaning should not be deferred beyond the twelfth month. It was further stated that the infant should be allowed a very small proportion of animal food as soon as it could masticate ; but to exhibit such diet before the necessary means of doing so are furnished it, were as irrational as it would be contrary to the indications of nature. A light nutritious diet of bread and milk, or the latter with rice, sago, salep, arrow-root, or tapioca, was recommended, and with these were enjoined strict attention to ablutions, air, exercise, and clothing—the avoidance of blisters, as far as possible—and

* Relaxation of the bowels.

the use of mild and inirritating medicines when required. With these and a few other remarks of minor importance, I concluded my first two letters, and with them the momentous period of infancy.

We are now prepared to pursue our onward course towards manhood, as rivers glide onward to the sea; but ere we arrive at that important emporium of life, it is necessary that we loiter a little by the way, to observe the successive stages of our route, and to bring their peculiarities to view. With this view we next turn our attention to

CHILDHOOD, which is usually understood to extend from the close of infancy to the completion of the seventh or eighth year. This epoch is characterized by rapid increase of development of the various organs, and the consequently augmented activity of their functions. The cranial bones, eight in number, are no longer held together by fibrous texture, but their sutures are distinctly ossified, and give to the skull the appearance of being composed of one entire bone. This, moulded by the artistic hand of nature into an irregularly spherical figure, is wisely adapted to afford secure lodgment to that special organ of the mind, which anatomists have termed the brain; but why, on this account, it is necessary that it should form a cavity enclosed on every side by bone, so as to differ from that in any other part of the skeleton, may, although evident to some persons, not be apparent to all. Presuming that many know not the cause, it will be well as briefly as possible to explain it. The brain—the most complex, and undoubtedly, the most

delicate organ of the human frame, in order to exercise a healthy presidency over those organs, which, although not wholly, are partially supplied by its nerves—such, for instance, as the lungs and stomach, and for the right manifestations of those high and intellectual faculties, by which man is distinguished from every animal, and placed pre-eminently first in the scale of organization, requires to be removed from atmospherical pressure, and every other external agent that might tend to its injury. Now, it is maintained by Monro, Abercromby, Kellie, and Bennett, that the substance of the brain is incompressible by any force that can be conveyed to it from the heart through the arteries that enter it, and that the blood, circulating in its vessels, can at no time, nor under any circumstances whatever, be materially increased or diminished, unless something give way to make room for the additional quantity, or except something enter to supply the place which would become vacant. If this hypothesis is correct, and that it is, it would appear from the experiments of Dr. Kellie, who, on examining the brain of certain animals bled to death, as well as of two men who had been hanged, found no deficiency in the quantity of their blood; but who, after removing a portion of the skull, and subjecting its contents to the pressure of the atmosphere, discovered in those animals that were sacrificed by bleeding, that the brain was blanched in like manner as any other organ of the body—I say, if this hypothesis is true, we, perhaps, see why the cranium forms an unyielding case of bone, enclosing

on every side that wonderful instrument of the mind—the brain. For from our knowledge of the physiological fact, that whatever organ is exercised, that organ in consequence receives a greater supply of arterial blood, it is probable that, were the brain unenveloped except by its membranes, on any excitement of the mind, or any increase of the heart's action, its blood-vessels would become congested with blood, and if that congestion were to continue but for a short period, apoplexy or inflammation might ensue, and death would be the result. Again, supposing the brain to be devoid of its bony case, were we to bleed a person to syncope, or actual fainting, we should, for the same reasons as before stated, naturally expect that, by diminishing its volume of blood, together with the atmospherical pressure on its surface, and the diminution of power in the muscular fibres of the heart, a fatal collapse of its vessels would follow.

Here, then, the power and wisdom of God are strikingly and wonderfully displayed—power, that could shatter into inconceivably minute particles the dark throne of chaos—power, that could still the tumultuous war of eternal elements—that could separate these, and assign to each a particular place in the universal vacuity—power, that could form with equal ease the great leviathan of the deep and the smallest insect of the forest leaf; and wisdom, from before whose transcendent blaze of light the mind shrinks abashed, and which mind, from the dawn of creation to the present era—from the birth of time through its course in the revolving cycle of years and

thousands of years, has never borne; nor from now, till this vast globe dissolve, till orb upon orb, and world upon world shall rush with a noise as of the whole artillery of heaven into annihilation, can it bear such Omnipotent effulgence! Yet through the instrumentality of our finite mind, and the powers which it displays, we are enabled, as it were, to enter the great laboratory of nature—to obtain, in some measure, the why and the wherefore of the multiplicity of things which are therein formed, and to trace, to a certain degree, the mysterious workings of the Great Mechanician of all. But to return to the point whence I set out in this digression—namely, to the natural changes going forward in the body.

I have noticed the union of the cranial bones by ossific matter, which implies a further advancement towards the completion of ossification. In the long bones, as those of the extremities, this further step can be traced in their increased length, thickness, and firmness, the last of which properties depends on a greater amount of phosphate of lime and other earthy substances. As these increase in quantity the animal substances of these parts diminish, till at length, they, according to the experiments of Fourcroy and Vauquelin, are reduced to fifty-one parts in a hundred. This is the quantity of animal matter in a hundred parts of bone of perfect development—the remaining proportions being represented by 37.7 of phosphate of lime, 10 of carbonate of lime, and 1.3 of phosphate of magnesia. You will, however, bear in mind, that, at this period, the bones have not at-

tained to this perfection, inasmuch as their extremities, or those parts of them which enter into the formation of the joints, are partly cartilaginous, and thus remain until long after the close of this period. I have said that they are partly cartilaginous, and, in doing so, I have made use of a technicality of which many probably know not the meaning, nor can they, indeed, be expected so to do. I find it extremely difficult to divest myself of such terms, and, in some instances, almost impossible for me to do so; but, as I take instruction to be their object, explanation of technicalities will be given, which, I trust, will afford them a clear conception of the thing under consideration. The word *cartilage*, then, is employed to designate a dense, highly elastic, resilient structure, of a white silvery colour, serving as an adjunct to bone, or as a substitute for it. We consequently find it reflected over the articulating extremities of bones, not merely to render them smooth, but also, by its elasticity, to lessen the effects of concussion. Its manner of arrangement is that of layers, which vary from half a line to two lines in thickness; while its chemical composition is *gelatine* with a small proportion of phosphate of lime. It likewise contains a large quantity of water, which, on its being exposed to the air, it loses by evaporation, and is thereby rendered yellow, semi-transparent, and inelastic. Cold water exerts very little action on it for some time; but by acids or boiling water it is readily converted into a gelatinous pulp.

During early infancy it forms a substitute for bone;

but as the process of development goes forward, osssific matter is deposited in its place, by which it is gradually supplanted, and its existence in such situations rendered temporary. It is, therefore, temporary as forming a part of the extremities of long bones during childhood, and its disappearance keeps pace with other changes actively going forward in other parts of the system at this period. Thus the brain is daily becoming firmer—the mind stronger—and the instinctive desires more in abeyance to the powers of reason. The countenance is more animated, the eyes are somewhat darker, more lively, and intelligent, and the hair is more copious, and a shade deeper in colour. The skin is one fourteenth of a line thicker; therefore less sensible to external impressions, and beneath it, in healthy children, a rapid deposition of fat takes place, which increases the rotundity of the body—tends to maintain its temperature—and acts as so much indirect nourishment in reserve, to be employed as the wants of the system shall hereafter require.

The chest is more capacious—the lungs are in comparison larger—the *thymus gland** is stationary—and the respirations are fewer in number within a given time. The heart, too, is larger and its walls

* This gland is situated partly within the chest and partly in the lower portion of the neck. It is distinguishable at the third month of fœtal life, from which period it increases until birth, thence to the completion of the first year, after which it is stationary for some time, then decreases to the time of puberty, and ultimately degenerates into a body of very small dimensions. Its existence may, therefore, be looked upon as temporary; while, according to Simon—the latest writer upon this subject—the purpose which it serves in the economy, is that of a "sinking fund" of nutrition during early development

thicker, particularly on the left side—its contractile power is greater, and its pulsations are reduced in number according to the age. The abdominal organs partake of the like iucrease of development, with the exception of the *supra renal capsules,** which are stationary. The muscles are more developed—their outlines better defined—and they are more capable of executing the manifestations of the will. In short every structure attests rapid development—a predominance of the assimilative powers over those of absorption—an actively vital extension—the limit of which is manhood—the *ultima linea* of which is—death! Hence death is the final consummation of all the functions of the material body; nevertheless it is an abstract idea, resulting from the cessation of every living action going forward in the system. This is death in the general acceptation of that term; but physiology recognises another and a partial death, which regards the constant change of the molecules or material particles of the body. These, during the process of nutrition, are deposited in the different structures, constituting bone, muscle, nerve, vessels, cartilage, ligament, tendon, &c., according to certain vital laws which do not admit of explanation; but, in a short time, their vital energy or attraction is overcome or lost, in consequence of which they become

* The supra renal capsules are two bodies which surmount the kidneys, aud which are larger than the latter during early fœtal life; bnt some time after birth they become shrivelled and diminished, and apparently lose the purpose which they at first served in the system. What that purpose is, we know not; nevertheless many vague and erroneous conjectures have been advanced respecting it, amongst which may be mentioned, for its seeming absurdity—*the power of secreting the red globules of the blood!*

dead to the system, and their elimination from it a necessary consequence, to make way for newer and more active particles, resulting from the proper assimilation of the food received into the stomach. Thus, in strict language, we are ever dying—ever mutable—ever changing! Atom by atom, our body is removed—atom by atom, it is again replaced; and in such a manner does nature economize her resources, that that, which a few months ago, formed a part of a limb, may now exist in the shape of a beautiful flower; and that, which to-day constitutes a portion of ourselves, may ere long compose the eye of an inferior animal, or a blade of the green herbage, thus proving the truth of the scriptural saying, that "all flesh is as grass", and the converse of this—all grass is as flesh.

Though our bodies are subject to this constant renovation and decay—though there are a continual building up and pulling down of the human fabric, yet, during the period under consideration, the materials deposited, are far greater in quantity than those taken away, and this law holds good throughout all classes of animals during the period of growth. It is in fact an inherent consequence of our nature, resulting from the activity of our functions, which, while it bears us forward to maturity, whispers to every mortal the immutable decree of the Divine will —that all organized beings shall perish, and be resolved into their ultimate elements, which, by assuming different combinations, may again burst forth into active existence, and once more bloom on the fertile plain of life.

Such is the use of matter! Such its definite end! How stupendous the results to which it leads! The mind, falling back upon itself, reflects with wonder and amazement on the important truth, that the very plants and earth which we tread beneath our feet, contain all the elements necessary for the formation of the brain of a Locke or a Newton, the mind appended to which, could dissect with wonderful ability the ideal portions of which it is itself composed, or trace, with unerring exactitude, the situation of the sideral bodies—their magnitude—their mutual relations—nay, even compute the time occupied in completing their revolutions in the planetary space!

Such is the offspring of life! Such are the results of organization! Such, therefore, the effect of nutrition! Particle with particle combines under the influcnce of what may be termed Vital Attraction, and the result of their combination is—a cell! Man, therefore, in the first stage of his existence, is a cell —a small sac of the size of a millet seed, containing a nucleus, and an atom of a pellucid fluid! In this minute bladder are contained principles sufficient for the development of a giant in the same manner as the acorn contains qualities for the production of an oak. The dormant principles of this cell once called into action, other cells are formed from it, and these again generate others, which, undergoing certain modifications, compose the various structures of the body, and thus a viable being is produced. To this method of production the term *cytogenesis* has been given, and to it we shall again have cause to recur.

In the meantime let it be impressed on your memory, that every change, as regards growth, results from cellular development, and that the different structures arising therefrom, are occasioned by the superaddition of other substances, resulting from a vitally selective power in the cells exercised on the nutritive elements.

On this view, a predominant selection of fibrine affords muscle; of gelatine, water, and a small portion of phosphate of lime, cartilage; of the last together with carbonate of lime and phosphate of magnesia, bone, which last, according to the shape which it assumes, affords either a basis of support for the body—a passive organ of prehension, or of mastication, as the teeth. To the last of these I shall now direct attention, because the change effected in their number during this period, is usually understood to limit the duration of childhood.

LETTER IV.

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In the first instance the teeth number twenty, and are equally arranged between the upper and lower jaws. Twelve of them are single and eight double. Of the former, eight are called incisor or cutting teeth, and these occupy the forepart of the mouth, and form the convex and prominent part of the dental arch. Immediately behind these, and on each side in both jaws, is the canine tooth, which is the last of the single teeth taken from before backwards. Beyond this again are situated the *molares*, or true grinding teeth, which are four in number in each jaw. All of them are deciduous, and are in due time replaced by permanent ones, to which are superadded twelve others, which thus swell the number to thirty-two. Of these twelve, eight are called bicuspid, or small molars, and are intermediate in size and situation between the canine and large molars, which latter, owing to the situation of the small molars, necessarily protrude at points farther back than did the so called temporary or deciduous ones. The other four rank with the true grinding teeth, and are situated at the farthest point of the jaw. They are likewise the smallest of their class, and from their non-appearance

until a more advanced period of life, have received the appellation of *dentes sapientiæ*, or the "wisdom teeth."

Each tooth presents a crown or that part which projects externally, a root, and an intermediate portion, termed the neck. Its osseous structure is remarkably hard, and contains no less than 73 or 74 per cent. of earthy matter, which is only surpassed in quantity by that of the enamel coating its crown, in which are 98 per cent. of earthy matter, including three of fluate of lime. This exceedingly large amount of earthy substances in the teeth, is sufficiently accounted for by reference to their function, and affords another proof of the admirable adaptation of parts to specific purposes.

The centre of each tooth is hollowed out into a cavity lined by a delicate membrane, on which the nerves and nutrient vessels ramify, after having entered through the foramina, or minute openings situated at the apex of the root.

Now, as the nerves are the sole conductors of every impression to and from the brain, or spinal cord, in the same manner as the poles of a galvanic battery are the gates for the transmission of the galvanic fluid to any object within the sphere of its action, and as the nerves supplying the teeth, are the second and third branches of the fifth nerve arising from the brain, it is readily imagined, and daily experience confirms the statement, that any irritation existing in the gums from the process of teething, is easily propagated to the brain, and, as irritation seldom exists for

any length of time without giving rise to inflammation, it is thereby seen how the integrity of this organ may be affected, and the life of the individual endangered.

Owing, indeed, to the activity of the functions during childhood, and to the rapid increase of vital cohesion in the different textures, diseases at this period, usually assume the *sthenic** character, and favour to a great extent the formative process.

Hence the Physician has to encounter various inflammations, as of the lungs, brain, stomach and bowels, besides which, glandular affections, epilepsy, worms, *angina*†, measles, scarlatina, small-pox, and other infectious diseases are prevalent. The number of deaths is therefore great, amounting, it is said, to one half of those born before they reach the eighth year—two-thirds before the thirty-ninth year, and three-fourths before the fifty-first. Of nine that are born, one only attains the age of seventy-three; of thirty, one only lives to the age of eighty—of 291, one attains the age of ninety—and of 11,996 one that of a hundred years.

According to Buffon, on whose authority the above calculations have been given, the mean term of life in a new-born child is eight years; but this is considerably advanced as the child becomes older and existence consequently more secure, so that after the completion

* Denoting power.

† A very painful disease, which comes on suddenly during exercise, especially whilst gaining an ascent, and which is characterized by violent pain across the chest extending to the arm, and accompanied by a sense of stricture so acute as to threaten immediate death. After repeated attacks the slightest cause induces a severe paroxysm, till at length the vital energies are so reduced, that death puts a period to a painful and miserable existence.

of the first year, it is rendered probable that he will attain the age of thirty-three.

Up to the period of the second dentition life gradually becomes firmer, and should the child escape the dangers of teething, forty three years and three months appear to be his allotted term.

After this, the sum of probabilities begins to observe an inverse ratio, in accordance with which, a youth of fourteen, cannot expect to live beyond thirty-seven years and five months—a man of thirty, twenty-eight years—and one of eighty-four, but one year, more. Such at least is the result of careful observation and calculation by Simpson, Wargentin, Barthez, Kersboom, Graunt, Buffon, Mourgues, D'Alembert, and Halley.

From these statements, together with our knowledge of the numerous diseases which may invade this important period, it is but rational to conclude, that the same amount of care is now necessary as was before given to the child during infancy. Great attention must, therefore, be paid to diet, which ought to be plain, nutritious, unstimulating, and very easy of digestion; neither should its quantity be too great nor its repetition too frequent, lest the digestive organs be oppressed, and the nutritive functions thereby suffer. The practice of over-feeding their children, in which too many mothers indulge, cannot be too severely reprobated; nor should the use of rich and stimulating food be allowed, since it not only tends to irritate the digestive organs, but also to diminish the different secretions on which perfect digestion

more or less depends. Thus the biliary secretion is perverted—the bowels become confined—fever and inflammation of the mucous membranes are not unfrequently engendered, whilst other diseases incident to this period are, in this manner, rendered more severe in their attack.

It is then, an important point, in the preservation of health, to regulate the quantity and quality of the food—a point with which many parents, perhaps, think themselves sufficiently acquainted, but which, from its numerous attendant diseases, not only exposes the fallacy into which they had fallen, but at once attests the triumph of reason over the seeming infallibility of common observation. Under the guidance of reflection and observation the diet may be so regulated, and the intervals of feeding so appointed, that, provided all other things be equal, a healthy condition of the system may generally be ensured, in which the child will flourish like a goodly tree, nor allow the meagre spectre—disease—to approach within the limits of its shade.

As one step towards effecting this desideratum, I would advise that the breakfast be taken an hour after rising, by which time every organ will have thrown off its partial inactivity occasioned by sleep, and the stomach thereby rendered fit for the reception of food. Were I inclined to recommend the usual plan of diet, I should advise that this meal consist of a moderate portion of new or old milk, according to the state of the body, and a proportionate quantity of moderately old bread. But contrary to all custom, I am, by rea-

son and reflection, fully convinced,that, if more solid food than this is taken during the day, it ought to form the substance of this meal.

Many may, perhaps, be surprised at such a statement; but if so, I doubt not their surprise will yield to honest conviction on my adducing the premises which have led me to this conclusion. To prove, then, the point which I have advanced, I set out by stating, that every structure of the body is formed from the blood, and that the growth and vigour of every organ depend on the purity of this fluid and the rapidity of its circulation. Hence a necessary corollary—the quicker the circulation the more rapid is growth, and the greater the tension of the function of organs.

This is exemplified by the gradual fall of the pulse and extension of the body from birth to adult age. At the former period the numbers, both for males and females, are, according to Quetelet, as follow:

MAXIMUM.	MINIMUM.	MEAN.	RANGE.
165;	104;	135.5;	61.

Again, according to Billard, the following is the frequency of the pulse in an infant of from

	MAXIMUM.	MINIMUM.	MEAN.	RANGE.
1 to 10 days old,	180;	less than 80;	106;	more than 100
1 to 2 months,	150	70	103	80
2 to 3 months,	100	70	87	30

According to Dr. Guy, whose observations on the pulse are worthy of the highest commendation, "the following table represents the number of the pulse at different ages, deduced from an average of twenty-five

observations at each age specified. All the observations were made in apparently healthy persons, fasting, in a state of rest, in the middle of the day, and in a sitting posture":

	Males.				Females.			
AGE.	Max.	Min.	Mean	Range	Max.	Min.	Mean	Range
1 week	160	104	128	56	160	104	128	56
2 to 7 yrs	128	72	97	56	128	70	98	58
8—13	108	70	84	38	120	70	94	50
15—21	108	60	76	48	124	56	82	68
22—28	100	53	73	47	114	54	80	60
29—35	92	56	70	36	94	62	78	32

The pulse, then, is the most frequent at birth, after which it gradually falls to adult age, up to which period the growth of the body observes a corresponding ratio, and is governed throughout by the rapidity of the circulation.

It is also an ascertained fact, that the pulse of a healthy male is, as a general rule, more frequent in the morning than at any other part of the day, and that it gradually falls as the day advances. Now, bearing in mind the fact, that the pulse is but the index to the rapidity of the circulation, and that on the quickness of the latter depends the activity of the functions, it is evident, that the digestive organs are the most able to discharge their office in the morning, and that food which requires the most digesting should, therefore, compose the chief portion of the morning meal. If, then, animal food is allowed a child, and that it should be, there can be no reasonable doubt, it ought, in my opinion, to be taken for breakfast, and as the

day advances, food which requires less and less digesting, for the later repasts. On this view, light puddings composed of bread, flour, rice, sago, tapioca, and such like substances, may be taken for dinner; whilst a due proportion of bread and milk should supply the place of tea. In this way the digestibility of the food is proportioned to the powers of the stomach, and thus many diseases, which have their origin in a disordered state of the digestive organs, are prevented.

In the use of new or old milk we must be guided by the idiosyncrasy of the child; for as no two constitutions of even healthy children are exactly alike, it is seen that the stomach of one child may digest new milk, while that of the other rejects it. In the former case, new milk may be allowed; but if, in the latter, we look upon the rejection of it as an effort of nature to rid herself of a substance too oppressive for her powers, old milk must be substituted; and although it contains a smaller portion of butter than new, yet its caseum and sugar of milk will afford sufficient nutritive elements for the growth of the child, and, therefore, render it admissible in many instances in which new milk cannot be taken.

In the use of either let it be borne in mind, that its temperature, at the time of taking it, should not exceed that of the blood, which is 98°, Fahrenheit; otherwise it is apt to overstimulate the delicate membrane of the digestive organs, and thus lay the foundation for subsequent disease.

In conjunction with milk I have recommended the

use of moderately old bread, and as there are several kinds of this article, all of which are derived from cereal grain, it is necessary to mention wheaten bread as being the most nutritious, from the greater quantity of gluten it contains. It is also more digestible than either oats, rye, or barley, the last of which, however, when deprived of its husk, which is acrid and laxative, is very nutritious; so much so, indeed, that Count Rumford regards barley-meal, when used for soup, as three or four times as nutritious as wheaten flour. To the same nutritive class as the above, belong rice, maize, or Indian corn, millet, and Sorghum, Durra, or Guinea corn, all of which are used by the different nations of the earth as articles of food. The best, however, of the cerealia, in point of nutritive properties and digestibility, is the wheaten bread, of which we have the fermented and unfermented, or unleavened. It is difficult to say to which of these two kinds the preference should be given; but with respect to fermented bread, it is well ascertained, that that which is prepared from flour only is the most nutritive and digestible; while that which contains bran, is somewhat laxative, and should only be employed in habitual constipation.

Of unfermented, or unleavened bread, biscuit is the best kind, and, provided it contain no butter, it will sometimes sit easily on the stomach when leavened bread disagrees.

With the use of proper food, active exercise ought to be taken in the open air; while due attention should be paid to cleanliness and clothing.

At this period it is usual to commence the education of the child, by its being consigned to school for several hours a day—a system which is fraught with danger to delicate children, and which often retards the growth of those who are stronger; for not only is an impure atmosphere inhaled, but the mind is often depressed—its energies are overtaxed, and the movements of the little sufferer restricted, by which the circulation becomes languid—the respirations fewer—the de-carbonization of the blood imperfectly accomplished—and the different organs thereby rendered incompetent to the due performance of their functions.

It were much better that a very lenient system of education should be pursued during early childhood, and that in the minds of parents, bodily development should take the preference of mental precocity, which latter condition is never acquired but at the certain expense of health, and the too frequently subsequent destruction of the child. It seems, therefore, more consonant with reason, and certainly with my views of the means of preserving health, for the young child to receive the first rudiments of his education in the fields, and to forego all confinement in the impure atmosphere of a school-room, until the body has acquired some development, and the constitution, is, as it were, securely based. When this is the case, a greater amount of care may be paid to the culture of the mind, and with this view, scholastic duties must be enforced, or rather so imposed on the child as to become a pleasure to him; under which treatment both the body and mind will observe a steady improvement,

and, in due course of time, acquire a perfect development. If we consider the natural irritability of the constitution—the buoyancy of the spirits—and the instability of the mind, we cannot resist the conclusion, that at this period, a rigid system of education was never intended by nature, and that her evident dictates are at variance with severe mental taxation, or concentrated literary reflection. By inattention to these particulars, how many young children have fallen victims to the over-anxiety of parents! How many have thus been consigned to a premature grave! Let me not, however, cast a reproach on the frailty of human nature, but earnestly endeavour rightly to direct your attention from the love of early embellishments in your children to the acquirement of a sound and vigorous constitution, which ought always to be parents' first and greatest care.

Insist, then, on the use of a plain, nutritious, and an unstimulating diet, and let its nature be governed by the diurnal revolutions of the pulse; permit no stimulating drink to be taken as a common beverage; allow sufficient exercise in the open air; avoid all confinement; observe cleanliness by frequent sponging, or the use of the cold or tepid bath; clothe your children according to the season of the year; and, if possible, let their dormitory be high, spacious, and well ventilated.

Here your anxiety and parental care must not cease; but they are to be further manifested in the arrangement of the bed and bed-clothes, and in the withholding of any article which might have an inju-

rious tendency on the health. With this view, the bed-clothes should be well aired, and curtains abolished, so that a free circulation of pure air may be admitted to all parts of the room; neither should the bed consist of down, feathers, nor wool, either of which, by confining the animal heat to the surface of the body, produces a general relaxation of the tissues, enervates the system, and thereby acts injuriously on the health. In the negation of these, a chaff or flock bed, or a hair mattress, will be found admissible, and by its use, the sleep will be rendered sound and refreshing, and the body fitted for the due performance of its various functions.

Here I close my remarks on this important period; here also I take a temporary farewell of my subject. But few shall be the matin songs that shall swell on the breeze, and short the flickering of the glow-worm's lamp, ere I return to my task, and once more revisit this harp of ten thousand strings, again to strike its silvery chords—again to interest you with the harmony of its notes, and to excite your mind to reflect on this masterpiece of creation—man!

LETTER V.

—o—

In accordance with my promise, I again address you on the important subject of my previous letters, and once more direct your attention to the interests of life.

By gradual steps it is mine to lead you through the successive changes which the body undergoes from the period of birth to mature age, from which, by an almost imperceptible decline, it glides to the place which is destined for its last repose. Half our ascent is already gained, and soon we shall reach the summit of the hill, whence we may overlook the operations of life, and in its revolutions trace the concatenation of cause and effect. It being unnecessary to retrace together our latest steps, or to dwell any longer on the second epoch of life, I turn my attention to the following epoch, which extends from the second dentition to the commencement of puberty, and which is known by the distinctive terms of

Boyhood and Girlhood.—During this period all the structures continue to grow—the solids acquire a greater degree of firmness—and the chemical composition of the body is altered. There is, therefore, less of watery and gelatinous constituents present in

the structures, and a greater amount of fibrine and phosphate of lime. To this gradual and continual change are owing the increase of strength in the muscular system, and the greater firmness and hardness of the bones. Hence, too, a greater ability to endure fatigue; hence also a greater conservative power in the vital resistance to disease.

The brain, spinal cord, and the various nerves are gradually assuming the density of mature age, and the manifestations of mind are consonant with the progressive change. Towards the middle and close of this period, the mental and physical distinctions of sex become more apparent, and, if no disease is present, the performance of the various functions is characterized by power, and thus a sthenic diathesis prevails. Hence the frequent presence of the sanguine or sanguineo-nervous temperament, and the liability to inflammatory diseases in the strong—to the infectious in the weak. Thus is the system, at this period, invaded by inflammations of the throat, windpipe, and lungs; by different nervous affections, as epilepsy, convulsions, and chorea (St. Vitus's dance); by *idiopathic** continued fever, tubercles in the lungs and alimentary canals, worms, curvatures of the spine, diseases of the skin, and scrofulous inflammation and enlargement, particularly of the *lymphatic glands.*† In the mention of these it will be seen how

* A disease which does not depend on any other disease, and is, therefore, opposed to a symptomatic disease, which is dependant on another.

† A lymphatic gland is formed of a contortion of lymphatic vessels, which vessels originate in every part of the body—carry a transparent fluid, called lymph, and form with those which carry the chyle from the intestines into the

many are the dangers of this period, and how great is the necessity for a proper knowledge of the management of health. Without any hope of non-medical persons being able to treat disease, and without any fear of their attempting such a thing, it may be remarked, that affections, at this age, generally require purgatives and low diet, unless the disease arise in a depraved constitution, or the type of it be of a low character, in which latter case the powers of life require to be supported, and the system upheld by the judicious use of tonic, or strengthening medicines. It were far better, however, to prevent, if possible, their occurrence by a well regulated diet and regimen, than to disperse them, by the aid of the physician, when once they have made an inroad on the constitution. Bear this fact, therefore, in remembrance, and let it have its due influence on your conduct as parents.

When your children shall have attained the age under consideration, enjoin exercise both of body and mind—let them enjoy active amusements in the open air, together with frequent ablutions, and change of air and of locality to open and healthy situations; neither permit them to sleep in the same bed with the old, nor with many in the same room, which ought to be spacious and well ventilated. As the digestive organs have now acquired sufficient power

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thoracic duct, and thus into the venous circulation, the absorbent system. By the action of these vessels the lymph is absorbed from the ultimate tissue of the whole body, from all the viscera and their cavities, and is thence conveyed into the thoracic duct, in which it mingles with the chyle above mentioned.

to digest every kind of food which is applicable to adult life, the further consideration of diet may be justly postponed until I come to speak of that period, when I purpose entering somewhat minutely into the different kinds of food. Meanwhile it is only necessary to take a cursory glance at any peculiarity of growth, or any susceptibility of the constitution to disease, during this and the succeeding epoch, and to confine myself to those remarks on regimen which the peculiar state of the system demands. Having done this, as regards the present epoch, I hasten to pass, in the like cursory manner, the peculiarities of that period of life, which extends from puberty to the twentieth year of females and the twenty-fourth of males, and which is usually understood by the term

Adolescence. In reference to puberty, its etiology is influenced by climate, constitution, and education; nevertheless in this country, it generally occurs from the twelfth to the fourteenth year in the female, and from the fourteenth to the sixteenth in the male. The colder the climate the later it appears, and the more its development is favoured by warmth, the sooner is it evolved. Of all the epochs of existence that of adolescence is probably the most important, inasmuch as all the organs are acquiring their full development—the brain, spinal cord, and nerves, their perfect and wonderful organization—and the mind its utmost vigour and power. Thus does the last become stored with ideas drawn from the study of nature—the writings, precepts, and examples of both the

ancients and moderns, as well as from the arts, sciences, and advancements of civilized life. These it digests and analyzes at pleasure—often recombines them with happy celerity—and presents them to the world in various, new, and attractive forms. Happy were it in such innocent industry, uninfluenced and ungoverned by the instinctive feelings and emotions, which now reach their utmost limit of activity, and which require the supervision of the experienced and the good.

Improve, therefore, the moral affections of the mind; inculcate sound principles of action and conduct, and control pernicious practices, which are too frequently begun at seminaries and schools, and which are often productive of physical exhaustion, mental torpor, and, in after life, innumerable diseases, arising from debility and loss of vital energy in the various structures and organs of the frame. Hence occur melancholia—mania (insanity)—idiocy—hysteria—epilepsy—neuralgia—chorea (St. Vitus's dance)—diseases of the heart—fevers—premature baldness and old age—transmission of weak bodies and intellects to the offspring—disorder of the digestive organs—tubercles—consumption—marasmus—rickets—worms—water in the brain—convulsions, &c.

Again turning our attention to the physical peculiarities of this age, we notice the increased development of the various muscles, the greater endurance of both bodily and mental exertion, and the perfection of the organs of respiration and of voice. Setting aside the characteristic distinction between the sexes

in the reproductive organs and their necessary appendices, there is, perhaps, no greater distinction between the male and female sex, than the change which occurs at puberty in the larynx, or upper part of the windpipe of the former, and the consequent modification of the voice.

This organ is composed of cartilages— ligaments to connect these—and muscles by which they are moved, together with a lining membrane, glands, blood-vessels, and nerves. Now, the first of these cartilages, taken from above downwards, is, from its supposed shield-like appearance, called the thyroid, and is the largest of the pieces composing the larynx, forming almost exclusively its anterior and lateral boundary; but being altogether deficient behind. This deficiency is supplied by another cartilage, termed the cricoid, which is situated immediately beneath the former, and presents an annular ring, the anterior part of which is very narrow, whilst the posterior projects upward for the purpose before named. On the summit of this projection are situated two other triangular cartilages, called the arytænoid, the base of which rests on the posterior part of the cricoid, whilst they are in close relation with each other by their inner borders.

Now, previously to the age of puberty, the larynx is similar in the male and female; but at this period, the anterior part of the thyroid cartilage in the male, which hitherto was round, projects forward at its middle, so that its sides form an acute angle with each other, whilst its forepart becomes more percepti-

ble at the upper part of the neck, thus constituting the *pomum Adami,* or "Adam's apple." At this time, too, the larynx is enlarged throughout, and its cartilages become thicker and stronger, while, owing to the advancement of the thyroid as before stated, the distance between it and the arytænoid is increased. This change leads to a necessary elongation of the vocal chords, which are four in number, the lower pair of which, being the true *chordæ vocales,* are attached posteriorly to the base of the arytænoid cartilages, and anteriorly to the thyroid, at the middle of its perpendicular depth. They, therefore, converge from behind forwards, and thus leave between them a triangular interval, called the rima glottidis, which, becoming greater in consequence of the above changes, allows more air to pass through it during each effort at speech, and in this manner renders the voice deeper and more approaching to bass.

To these characteristic distinctions of the male sex, another may be added in the appearance of the beard towards the close of this period, and in the growth of hair on other parts of the face.

As healthy action is now characterized by vigour, so also is diseased action marked by power. The latter, therefore, is rapid in its progress, and is often witnessed in inflammation of the lungs, brain, and its membranes; in idiopathic fevers, the evolution of tubercles in the lungs, and in diseases of the reproductive organs.

In the generality of such affections, except the constitution be at fault, vascular depletions and

*antiphlogistic regimen** are required; but these means the intelligent physician invariably employs with due regard to the habits, constitution, temperament, and physical powers. The vital and physical energies of the system, being much greater than those of the preceding epoch, whilst they are less than those of adult age, its diseases are fewer with respect to the former, and more numerous than those of the latter period, of which I now pass on to speak.

Adult Age is subdivided into early adult and mature age, or perfect virility. Of these the former extends from the twentieth to the thirtieth year in the female, and from the twenty-fourth to the thirty-fifth in the male; and the latter from the thirtieth to the fortieth year in one instance, and from the thirty-fourth to the forty-eighth in the other.

The body has at length ceased to increase in stature, and the process of ossification is now completed; nevertheless the various muscles, which are under the absolute dominion of the will, augment in bulk, and the whole frame continues to acquire strength. Hence the features, character, disposition, temperament, and diathesis, are rendered more apparent, while the increased vital resistance enables the system to bear up under continued privations and fatigue.

In mature age the chest is fully developed—the body spare and active—the abdomen small—and in

* The term antiphlogistic is applied to those medicines, plans of diet, and other circumstances, which are opposed to inflammation, or by which the activity of the vital power is diminished, and the system thereby weakened.

those who are actively employed, the system is but little encumbered with fat. In epicures, on the contrary, as well as in those of sedentary habits, the abdomen is large, the limbs are small and weak, and there is a great collection of fat beneath the skin, between the muscles, in the abdomen, and round the kidneys.

It is now that the features are modified by the various passions and mental emotions, and the system is influenced by occupations, appetites, and habits. Yet are these periods the most exempt from disease, until at length, towards the age of forty or fifty, the circulation through the veins becomes languid, and this not unfrequently leads to congestion, visceral obstructions, bilious affections, piles, inflammations, apoplexy, paralysis, and many other diseases. At this period, therefore, life has passed the meridian of its glory, and the system is almost imperceptibly gliding into the sear and yellow leaf. It is, however, with the close of early adult age that we have most to do. It is then that we witness man in the enjoyment of his greatest physical strength, and the mind in the plenitude of its powers, solving the most difficult problems, or busily engaged in bringing to light the mysteries of nature, and accomplishing the apparently almost impracticable task assigned us by the poet:—

> "Go, wondrous creature! mount where science guides,
> Weigh air, measure earth, and calculate the tides."

Hence man, in whatever situation placed, has held the prerogative to superiority in the animal kingdom, and not only do his intellectual faculties lift him

above the level of the brute, but by the superiority of the strength of his frame and the flexibility of his nature, he is better able to bear the diversity of climate, and can, therefore, exist in every part of the globe.* From the burning sands of the tropics to the frozen regions of the north, upon the highest mountains and in the lowest valleys, this being of our consideration exists, thrives, and is less affected by such diversity of climate than any other animal. Amidst the icy deserts of the north the Greenlander and Esquimaux have reached a latitude of between 70° and 80°, and in the same situation Danish settlements have been formed. The Negro, on the contrary, lives under the equator, while the whole of America to Terra del Fuego is inhabited by the human race. Thus man can inhabit the hottest and the coldest regions of the earth, and he has even extended his species to every known part of the habitable globe. Even at a temperature in which mercury freezes in the open air, and brandy in rooms in which fires are kept, the Canadian savages engage in the chase, and bear with impunity this intense degree of cold.

Yet is it not surprising that the European, who has been accustomed to warmer climates, can expose himself without injury to such a low degree in the thermometrical scale? Such, however, is the case, as is seen by the fact, that the Danes have lived in Greenland, in 72° north latitude, whilst the Dutch, under Heemskirk, passed the winter at Nova Zembla, where even the polar bears could not withstand the

* Vide Lawrence's Lectures on Man.

cold, but retired to their haunts as soon as the sun had sunk beneath the western horizon.

But this power in the human body of withstanding cold, appears the more remarkable from a knowledge of the comparative degree of heat which it is enabled to sustain. It was maintained by Boerhaave, that man could not exist in a temperature of from 96 to 100°; but this assertion appears to be invalidated by the following facts :—

At Sierra Leone, Messrs. Watt and Winterbottom saw the thermometer at 103°, and Adanson witnessed it at 108½° in the shade at Senegal. Buffon has also related an instance, in which it stood at 117½°; and, according to Bydone, during the period of the sirocco in Sicily, the temperature rises to 112°. Other instances of the thermometer's attaining a high elevation might be adduced; but the foregoing are sufficient to convince us of the great protective power in our body against the extreme degrees of heat and cold.

By virtue of this power we are also enabled to support different amounts of pressure. Thus, when the barometer stands at 30 inches, the pressure of the air, at the level of the sea, on the whole surface of the body, is estimated at 32,325 lbs; but this weight is reduced to 21,750 lbs. at an elevation of 12,000 feet, at which height the barometer measures 20¼ inches.

It is said that two Frenchmen—Condamine and Bouguer—and their attendants lived three weeks at an elevation of 14,604 French feet, at which altitude the barometer sank to 15 inches 9 lines, thus shewing the pressure of the atmosphere to be 16,920 lbs.

From the foregoing data it is inferred that man, by the physical capabilities of his frame, can bear any diversity of climate, and this deduction involves a question, as to whether he is omnivorous—that is, can he derive sufficient nourishment and support from all kinds of food? Undoubtedly he can; for if this power were not granted him, restriction to one kind of food would be fatal to him in situations where this could not be obtained. Amidst the icy deserts of the arctic region and in the torrid zone, where the whole face of nature presents an opposite appearance, man is found to exist and to be by nature adapted to the peculiarity of the climate. Hence, on the ice-bound coast of Greenland—the barren wastes of Lapland—and along the dreary coast of the Icy Sea, where vegetation is unknown for the greater part of the year, the food of the natives is afforded them by the animals which inhabit those regions. Thus the seal, whale, and rein-deer, are killed for their flesh, the first of which, although it be undergoing putrefactive decomposition, is eaten by the natives of Greenland with as keen a relish as the European manifests over his nicest dainties. Here, too, the blood of this animal is drunk warm, and dried herrings, moistened with whale-oil, form a choice article of diet. The whale, too, is often eaten without being improved by the art of cooking; and we are further told, that the Russians, who winter at Nova Zembla, imitate the Samoyedes, by drinking fresh rein-deer blood, and eating raw flesh, in order to preserve their health.

Thus it appears that a sound state of health is

compatible with the use of the coarsest articles of food, which, amongst the inhabitants of the climates of which I have spoken, are chiefly animal—the product of the chase and the fishery.

Beneath the tropics, on the contrary, the varieties of our species subsist chiefly on vegetable aliment, as circumstances are unfavourable to the rearing of flocks in sufficient numbers to supply the whole population with animal food. But although such obstacles exist in the periodical rains and inundations—the intense solar heat, by which all fluids are absorbed, and all succulent vegetables destroyed, as well as in the number, strength, and ferocity of predacious animals, yet this scarcity of flesh is abundantly compensated for by a number of most grateful vegetable productions, such as sago, banana, maize, rice, plantain, millet, the cocoa, potato, and a variety of other fruits.

In this situation a vegetable diet is far more wholesome than animal food, and the sensations occasioned by it, are much more grateful to the individual who takes it. Thus we see that nature accommodates herself to our particular wants under every variety of climate. In the temperate zone this truth is strikingly manifested in the existence of a variety of both animals and plants, which are both wholesome and nutritious, and which are, therefore, taken daily as articles of food. Hence, in this part of the globe, man appears in his omnivorous state; but as we diverge towards the equator or the pole, he partakes more of the herbivorous or carnivorous character.

In pursuing this subject, with respect to man's

natural aliment, it will not be uninteresting to inquire whether the bodily and mental powers can or cannot be affected in their development by a vegetable or an animal diet exclusively; and, on this point, I shall first quote the words of Buffon, the celebrated naturalist:—

"The Pythagorean diet," says this author, "though extolled by ancient and modern philosophers, and even recommended by certain physicians, was never indicated by nature. If man were obliged to abstain totally from flesh, he would not, at least in our climates, either exist or multiply. An entire abstinence from flesh can have no effect but to enfeeble nature. To preserve himself in proper plight man requires not only the use of this solid nourishment, but even to vary it. To obtain complete vigour he must choose that species of food which is most agreeable to his constitution, and, as he cannot preserve himself in a state of activity but by procuring new sensations, he must give his senses their full stretch, and eat a variety of meats, to prevent the disgust arising from a uniformity of nourishment."

In opposition to the opinion expressed by Buffon, we read that, in the golden age, acorns were man's natural aliment, and that his drink was the limpid stream from the fountain. Having a sufficiency of food in every situation, he lived without anxiety in the world, and was at peace with his fellow-man and the inferior animals. But no sooner did he descend from his primeval state, and unite himself with his fellow-men in the bonds of society, than war and the

iron age commenced; and, under this change, his nature became depraved, and was accompanied by collateral manifestations of cruelty, and an insatiable desire for flesh and blood.

These statements, however, are fully disproved by experience; and, as examples that animal food does not render man strong, daring, and courageous, reference needs only to be made to the Laplanders, Tungooses, Samoyedes, Ostiacs, and Burats, as well as to the Esquimaux and the inhabitants of Terra del Fuego, in the northern and southern parts of America, the last of whom, although they subsist chiefly on flesh, are the lowest, weakest, and least courageous known people on the earth. That a vegetable diet, on the contrary, is not productive of weakness and cowardice, sufficient proofs exist in the Grecian and Roman histories, from which we learn that, during the period of the highest ascendency of those nations, the Greeks and Romans observed almost exclusively this mode of living—a method which, in addition to the use of bread and other productions of the earth, is still in vogue amongst the Italians, as well as with the greater bulk of the population in most countries of Europe. It may further be remarked, that at this time, the Irish and Scotch live freely on vegetable aliments, yet they are not thereby rendered weaker than their English brethren, who observe a greater use of animal food. In addition to this, the Negro subsists chiefly on vegetables, as do also the South Sea Islanders, whose strength and agility were such that the most expert English Sailors were soon

defeated by them in wrestling and boxing.

From these facts it must be inferred, that we partake of both the carnivorous and herbivorous character, and that a mixed kind of diet is, therefore, the best adapted to our constitution. While other animals live entirely on flesh or vegetable substances, our organization befits us for the reception of both; and, in this respect, as well as in the higher endowments of the mind, we have no parallel in nature.

It is hence seen that our means of support are drawn from both animals and vegetables; but, as the food of the former is derived from the latter, strict philosophy argues that our whole source of nutriment is indirectly derived from the vegetable kingdom. So great, indeed, is the part which vegetable aliment appears to perform in the formation of the ultimate organism, that the illustrious Liebig maintains, that

"With the exception of the substance of cellular tissue of membranes, and of the brain and nerves, all the organic materials of which the animal body is composed are derived from vegetables, which alone possess the property of producing compounds of proteine."

This substance being of a highly nitrogenised nature, it is hence inferred, that nitrogenised foods are alone capable of conversion into blood and of forming organised tissues, and that such nitrogenised foods as albumen, fibrine, caseine, and gluten, which contain proteine, alone form the albuminous and fibrinous tissues. On the other hand

"Non-nitrogenised foods support the process of

respiration, by yielding carbon, and, in some cases, hydrogen to be burnt in the lungs, and thereby to keep up the animal temperature."

Thus gum, sugar, starch, vegetable jelly, and lignin are of this class, while the above four nitrogenised principles, together with gelatine, take part in the transformation of the tissues. It is, however, believed by Liebig, that the last mentioned substance is incapable of conversion into blood; but that it may serve for the nutrition of the gelatinous tissues, as cellular tissue, membrane, and cartilage.

On a careful review of these statements it will be seen, that the due maintenance of the body requires the presence of both nitrogenised and non-nitrogenised aliment—the former for the purpose of building up the tissues, and the latter to prevent their consumption, by supporting the process of respiration.

These means, by a wise ordination of nature, are furnished by animals and vegetables, on the consideration of which, as far as they regard food, it is necessary now to enter.

LETTER VI.

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For animal aliment we are indebted to mammals, birds, fishes, reptiles, crustaceous animals, and mollusks. Hence they may be arranged in six classes, the first of which comprises the ox, sheep, hog, hare, rabbit, and deer, of which the flesh and viscera, the blood of the hog, and the milk of others are employed for food.

Into the composition of the flesh enter muscle, which forms its principal part—tendons, nerves, vessels, cellular tissue, blood, serum, and fat, the chemical constituents of which are fibrine, albumen, gelatine, hœmatosin, or the colouring matter of the blood, fatty matter, osmazome, a peculiar nervous matter, salts, and a substance, detected by Chevreul, termed creatine.

Of the first three of these constituents, analysis has detected in a hundred parts of muscle of

	Water.	Albumen.	Gelatine.	Nutritive Mat.
Beef	74	20	6	26
Veal	75	19	6	25
Mutton	71	22	7	29
Pork	76	19	5	24

Now, experience has established, that the younger the animal, the more tender is its flesh, which is also greatly improved in delicacy, odour, and flavour, by castration in the male, and by spaying in the female. On some of these properties, too, and also on the minuteness of division depend the digestibility of animal food, and its relative value as a diet. The more, therefore, the food is masticated and reduced into small particles by the teeth, the less is the labour thrown upon the stomach, and the more likely is that organ to escape functional disturbance. By boiling flesh in water, the latter becomes impregnated with gelatine, fatty matters, osmazome, and creatine; while the fibrine is corrugated, and the hœmatosine and albumen coagulated, which last substance, however, by a continued action of heat and water, yields a soluble azotised matter.

Of the viscera, the brain, liver, spleen, lungs, thymus gland, kidneys, and alimentary canal are used as food, all of which abound in albumen, and are, therefore, highly nutritive. The mean time of digestion of several of these and of some of the above foods has been ascertained to be for

	Hours.	Minutes.
Tripe, soused, boiled	1	... 0
Pigs' feet, soused.	1	... 0
Brains, animal, boiled.	1	... 45
Liver of the ox, fresh, broiled	2	... 0
Venison steak, broiled.	1	... 35
Sucking pig, roasted	2	... 30
Lamb, fresh, broiled.	2	... 30

Beef steak, ditto	3 ...	0
Ditto, fresh, dry, roasted.....	3 ...	30
Ditto, steak, broiled.....	3 ...	0
Ditto, with salt only, boiled. ...	2 ...	45
Ditto, with mustard, &c., boiled	3 ...	30
Ditto, fresh, lean, fried	4 ...	0
Ditto, old, hard, salted, boiled	4 ...	15
Mutton, fresh, broiled.....	3 ...	0
Ditto, ditto, roasted.....	3 ...	15
Ditto, ditto, boiled	3 ...	0
Pork steak, broiled	3 ...	15
Pork, fat and lean, roasted.....	5 ...	15
Ditto, recently salted, boiled ...	4 ...	30
Ditto, ditto, fried.....	4 ...	15
Ditto, ditto, broiled...	3 ...	15
Ditto, ditto, raw	3 ...	0
Ditto, ditto, stewed...	3 ...	0
Veal, fresh, broiled	4 ...	0
Ditto, ditto, fried.....	4 ...	30
Gelatine, boiled.	2 ...	30
Suet, mutton, boiled.	4 ...	30
Heart, animal, fried.....	4 ...	0
Tendon, boiled.	5 ...	30
Cartilage, ditto.	4 ...	15
Aponeurosis, boiled.....	3 ...	0
Sausage, fresh, broiled.	3 ...	20

It is here worthy of remark, that bacon, black puddings, and sausages cured by smoking, have sometimes, by keeping, acquired highly deleterious qualities, which, in the case of sausages, are ascribed by Buchner, to the presence of a *botulinic acid.*

In addition to these substances, the milk of the cow and occasionally of other animals, forms a valuable article of diet; but it having previously occupied our attention, it will only be necessary to notice the butter and cheese which it contains. Of these the former possesses no directly nutritive principles, inasmuch as its analysis shows it to be destitute of nitrogen, which, according to the views of Liebig, must enter into the composition of that food, which is capable of conversion into tissue, the destruction of which butter nevertheless prevents, by supporting the process of respiration, in the yielding of its 65.6 per cent. of carbon, to combine with the oxygen taken into the lungs, which would otherwise enter into combination with this element of the tissues, and thus destroy them. With cheese, however, the opposite is the case, for being chiefly composed of caseum, which is a highly nitrogenous substance, it possesses the property of conversion into blood, and of becoming a part and parcel of the body. Although it is thus nutritious, yet it is difficult of digestion, and is said to occasionally acquire poisonous properties by keeping. Now, there are several kinds of cheese, the richness of which depends on the quantity of butter they contain. Thus Stilton cheese is the product of milk to which cream has been added; Cheshire and the best Gloucestershire, of unskimmed milk, whilst Suffolk and Parmesan cheeses are prepared from milk which has been skimmed. The last two, therefore, are simply convertible into tissue; whilst the first three kinds possess this property in a less degree, in

addition to that of supporting respiration. Were it possible for any one substance* to support life, it might justly be observed, that on one kind of cheese, a man would ultimately starve to death; whilst on another kind, he would flourish in the most perfect health and vigour!

Of birds, the eggs and flesh are taken for food, the former of which owe their nutritive properties to the albumen of the glaire and yolk, as well as to the oil of the latter substance.

In 100 parts of the white of egg there are 12 of albumen, 2.7 of mucus, 0.3 of salts, and 85 of water; and in the same quantity of the yolk, there are 17.47 of albumen, 28.75 of yellow oil and fat, and 53.78 of water. These statements express the amount of nutritive matter contained in the egg, the digestibility of which is more or less impaired by the process of cooking. Heat communicated to it beyond the temperature of 160° F. coagulates its albumen, which, owing to nutrition's requiring the nutrient elements to exist in a fluid state, must again assume the liquid form before it can be applied to the organism. In doing this, its digestibility is, as before stated, greatly influenced by the manner of preparing it for the table, which, if done by frying in butter or oil, renders it extremely difficult of digestion. But otherwise prepared this process occupies for

	Hours.	Minutes.
Eggs whipped, raw	1	... 30

* By the Commissioners of the French Academy it is stated, that *gluten* from maize, or wheat, is alone sufficient to carry on full and prolonged nutrition.

Ditto, fresh, raw	2	... 0
Ditto, ditto, roasted.	2	... 15
Ditto, ditto, soft boiled	3	... 0
Ditto, ditto, hard boiled.....	3	... 30
Ditto, ditto, fried.....	3	... 30

Of the flesh of birds that of the common dunghill fowl is the least irritating or stimulating of all animal foods, and this property it owes to the small proportion of osmazome which it contains, when compared with the flesh of other animals. It is white, and, when young, very tender and easy of digestion, requiring two hours and forty-five minutes for the accomplishment of this process, and containing 27 per cent. of nutritive matter, of which albumen represents twenty, and gelatine the remaining seven.

Partridge and pheasant are darker coloured, firmer, and contain more osmazome, owing to which they are more stimulating and somewhat less digestible ; while waterfowls, as the goose and duck, are generally firm and loaded with fat, which render them extremely difficult of digestion.

In the time of Pliny the enlarged liver of the goose was esteemed a delicacy, which is even at the present procured at Strasburg and Metz, by cramming the animal with artificial food, keeping it in a cage in a dry place, and giving it water mixed with charcoal to drink. By these means the functional activity of the liver is greatly increased, the quantity of blood in its vessels is augmented, and, in a short time, it presents an enlarged and a diseased mass. In this condition it contains a quantity of

phosphoric oil, which repays the *over-refinement* of the palate, by throwing a much greater amount of labour upon the stomach.

With respect to fish, that which abounds in phosphoric oil is the most nutritive, but, at the same time, least digestible. Hence salmon, herrings, eels, and sprats, occupy a longer time in digesting than haddock, sole, flounder, whiting, cod, and turbot, which are the least stimulating, and the best of their class in common use.

The quantity of nutritive matter in several of these kinds was found by Professor Brande to be for a hundred parts of the muscle of

	Water.	Albumen.	Gelatine.	Nutritive Mat.
Cod	79	14	7	21
Haddock	82	13	5	18
Sole	79	15	6	21

In addition to these, Morin detected in the flesh of the Smelt, yellow phosphoric oily matter, osmazome, mucus, muriate of ammonia, phosphates of potash, lime, iron, and magnesia, chloride of potassium, and carbonate of lime.

Fish is less satisfying to the appetite, and certainly less nutrient than either mammals or birds, and, with respect to digestibility, it is, except when fresh, quite as resistant to the action of the stomach as the flesh of the latter. Thus cod-fish, cured dry, and boiled, requires two hours in digesting; flounder, fresh and fried, three hours and a half; and salmon, salted and boiled, four hours.

Besides the flesh, the swimming-bladder, in the shape of *sound* and *isinglass*—the roe, or ovary—and the milt, or testicle, are used as food, the nutritive properties of which are referrible to the presence of gelatine and phosphoric oil. To the presence of the latter is also ascribed the stimulent effect which fish is said to exercise on the reproductive organs; while to the salts which it contains, may probably be referred the thirst sometimes occasioned by its use, and the prevalence of skin diseases amongst those who regard it as a principal article of food.

In both temperate and tropical climates, but especially in the latter, some species of fish either occasionally, or at all times, possess poisonous properties, of the influence of which some persons are more susceptible than others. It will, therefore, be of advantage to you to know, that the flesh of any fish is always in the greatest perfection during the ripening of the milt and roe, and that, after the deposit of the spawn, it becomes soft and wanting of its peculiar flavour, in consequence of the exhaustion of its oil or fat in the function of reproduction.

Amongst reptiles, the Green or Edible Turtle is the only one which is used in this country for food. It is said to be highly nutritive, and, when plainly cooked, easily digested; but, in the form of "turtle soup," it is less digestible, and is, therefore, unsuitable to the dyspeptic.

To the class of crustaceous animals belong crabs, lobsters, craw-fish, shrimps, and prawns, all of which have a white, firm flesh, which contains a large

quantity of gelatine, and which is difficult of digestion.

Under mollusks are ranked the oyster, muscle, cockle, periwinkle, limpet, and welk, the composition of which is chiefly water and a small proportion of mucus, osmazome, albumen, fibrine, and gelatine. Hence they are nutritive; and, with respect to digestibility, much better in their raw state than roasted, scolloped, or stewed. By heat their albumen is coagulated and hardened, and their fibrine corrugated, owing to which and to the butter employed in cooking them, their digestibility is greatly impaired. Thus the mean time of digestion was found, by Dr. Beaumont, to be for

	Hours.	Minutes.
Oysters, fresh, raw.....	2 ...	55
Ditto, ditto, roasted	3 ...	15
Ditto, ditto, stewed.	3 ...	30
Oyster soup, boiled.	3 ...	30

Quitting the subject of animal aliment, I now direct your attention to that of the vegetable kingdom, from which the seeds, leaves, roots, stems, fruits, and other parts of plants are employed as food.

Of seeds, the most important are wheat, oats, barley, rye, rice, millet, Indian corn, Sorghum, Durra, or Guinea corn, of the cerealia; and peas and beans of the leguminous kind. These owe their nutritive properties to starch, sugar, gum, and gluten, the last of which, in consequence of its being a nitrogenous substance, assists in the formation of the tissues; whilst the first three, from their want of nitrogen, are, according to the views of Liebig, nothing more than

supporters of respiration, and thereby of animal heat.

In reference to wheat, the following is the analysis of various kinds, according to Pareira, to whose valuable writings I am indebted for other facts herein stated.

	French Wheat.	Odessa hard Wheat.	Odessa soft Wheat.	Ditto	Ditto.	Flour of Paris Bakers.	Ditto of good quality.	Ditto. inferior kind.
Starch....	71.49	56.50	62.00	70.84	72.00	72. 8	71. 2	67.78
Gluten ..	10.96	14.55	12.00	12.10	7.30	10. 2	10. 3	9.02
Sugar	4.72	8.48	7.56	4.90	5.42	4. 2	4. 8	4.80
Gum	3.32	4.90	5.80	4.60	3.30	2. 8	3. 6	4.60
Bran		2.30	1.20					2.00
Water	10.00	12.00	10.00	8.00	12.00	10. 0	8. 0	12.00
	100.49	98.73	98.56	100.44	100.02	100.0	97. 9	100.20

The following is the composition of oats, according to Vogel:

	Parts.
Starch	59.0
Gum	2.5
Grey albuminous matter	4.3
Bitter matter and sugar	8.25
Fixed oil	2.0
Husk and loss	23.95
	100.00

Of Barley, according to Einhof:

	Parts.
Meal	70.05
Husk	18.75
Water	11.20
	100.00

A hundred parts of barley-meal consist of

	Parts.
Fibrous Matter...	7.29
Gum	4.62
*Albumen...	1.15
Starch	67.18
Uncrystallizable Sugar	5.21
Gluten	3.52
Superphosphate of lime with albumen	0.24
Water	9.37
Loss	1.42
	100.00

According to the same author, rye consists of

	Parts.
Meal	65.6
Husk...	24.2
Moisture	10.2
	100.0

The meal is composed of

Gum	11.09
Starch	61.07
Gluten	9.48
Albumen	3.28
Woody fibre	6.38
Uncrystallizable sugar	3.28
Undetermined acid and loss	5.62
	100.20

* As albumen cannot be detected in the contents of the stomach of the herbivora, nor yet in the chyme of that of man, unless animal food has been taken, and as albumen and gluten are identical in composition, the albumen expressed in the text is, in this and other analyses of vegetable foods, more properly to be regarded as gluten. This statement is in direct opposition to the views of Liebig, who maintains that not only does albumen but also fibrine pre-exist in vegetables—an assertion which the experiments of Dr. Prout seem fully to disprove, and which, therefore, warrant the inference above stated.

Of the use to which cereal grains are applied in the form of bread, I have before spoken. It is, therefore, only necessary that I here speak of them as constituting puddings, tarts, pancakes, &c. Of puddings, those are the best which contain the least butter or fat of any kind, and on this view, the preference is to be given to that composed of bread and boiled flour, which, from its lightness of texture is more digestible than batter pudding, although the latter is free from butter. By the action of heat on the butter or lard which is employed in pastry, tarts and such like things are rendered extremely indigestible; and this remark is equally applicable to pancakes, the greasiness of which makes them highly objectionable.

With respect to pease and beans, their indigestibility is in proportion to their age; but this nevertheless renders them more nutrient, the amount of which property in a hundred parts is expressed by the following analysis by Einhof.

	Pease.	Garden Beans.	Kidney Beans.
Starch	32,45	34,17	35,94
Amylaceous fibre	21,88	15,89	11,07
Legumen	14,56	10,86	20,81
Gum	6,37	4,61	19,37
Albumen	1,72	0,81	1,35
Extractive matter	2,11	3,54	3,41
Membrane	——	10,05	7,50
Water	14,06	15,63	(dried)
Salts	6,56	3,46	0,55
Loss	0,29	0,98	——
	100,00	100,00	100,00

In addition to these, the chestnut, walnut, almond, cashew-nut, pistachio-nut, hazel-nut, stone-pine-nut,

and the cocoa-nut, are taken more as a luxury than as food; but all of them, with the single exception of the chestnut, are rich in oil, which, although it confers upon them so much indirectly nutritive property, renders them extremely indigestible.

With leaves, the lettuce, endive, white mustard, common and water-cress, furnish us in the form of salads; and the cabbage, brocoli, savoy, cauliflower, and spinach, after boiling, as common food; but all of them contain very little nourishment, and are to be regarded as pleasant adjuncts to other and more substantial food.

Amongst roots and tubers the potato is by far the most useful, and, when properly cooked, is a very nutrient article of food. In structure it is apparently composed of cells, each of which contains ten or twelve grains of starch and a glutinous fluid, which latter also exists in the spaces between the cells. By analysis it is found to consist of starch, gluten, salts, acids, gum, and water, the relative proportions of which vary not only with the varieties, but also according to the season of the year. Thus in August a hundred pounds of potatoes will yield about 10 lbs. of starch; in September 14½ lbs.; in October 14¾ lbs.; in November and March 17 lbs.; in April 13¾ lbs.; and in May 10 lbs. Boiling has the effect of separating their cells, and of causing the starch-grains to absorb the glutinous fluid, while that in the intercellular spaces, is coagulated and converted into fibres, which are situated between the amylaceous grains. If this process has not been carried sufficiently far,

the glutinous fluid is only partly absorbed, and its coagulation in the inter-cellular spaces imperfectly accomplished, in consequence of which the potato is rendered doughy or watery. In this state it is less digestible than when it is in that condition which is termed "mealy"; nevertheless its greatest digestibility is effected by boiling it until it is easily mashed. That potatoes contain a noxious principle is evident from the fact, that the water in which they have been boiled, has occasionally been found to possess poisonous properties; but this principle being either extracted or destroyed by the water during the process of boiling, they are perfectly innocuous when brought to the table.

Of turnips, carrots, and parsnips, the first are probably the most nutrient as well as the most digestible, whilst from the following analysis of the expressed juice by Wackenroder, it will be seen that carrots contain an oil, which renders them unpleasant to many persons, as well as unfit for the stomach of the dyspeptic.

In a hundred parts of the expressed juice of carrots evaporated to dryness, there are of

	Parts.
Uncrystallizable sugar with some starch and malic acid.	93.71
Albumen	4.35
Alumina, lime, and iron.	0.60
Carotin	0.34
Fixed oil with some volatile oil ...	1.00
	100.00

With these, leeks, shallots, garlic, and onions, are generally classed; but, strictly speaking, they are subterranean buds with thick and fleshy scales. As they contain sugar, gum, woody fibre, and albumen (gluten ?) they are so far nutritive; but this property they, according to some writers, are unable to impart to the system until their acrid volatile oil has been dissipated by boiling.

In addition to these, the artichoke, rhubarb, the farinaceous substance of some palms and ferns, lichens, sea-weeds, mushrooms, and fleshy fruits, are employed for food, the amount of nutritive matter in which varies according to their particular kinds, and their digestibility according to the density of their texture. Hence, amongst fruits, the pulp of the ripe grape and gooseberry, of the orange, lemon, citron, lime, tamarind, and figs, together with the pine-apple, mulberry, strawberry, and raspberry, are more easy of digestion than the apple, pear, quince, and melon, and the latter than the plum, cherry, peach, apricot, and nectarine.

LETTER VII.

—o—

Having now gone through the various solid foods, from which is derived the necessary plastic element for the formation of every tissue, I next direct your attention to drinks and condiments. Of the former of these, water evidently holds the most conspicuous place, and not only is it entitled to this distinction from its universality, and from the fact of its being the only natural production of this kind of aliment, but also from its importance in the animal economy. Alike important to the animal and vegetable kingdoms, nature every where is enlivened by its presence, but sickens, droops, and decays when its vital stimulus is withdrawn. Turn but your attention to the flowers of the field—observe them gradually unfolding their dew-lipped urns in the dawning beam of a summer's day—mark the freshness, the beauty, and the richness of their varying tints, and the elasticity with which they yield to the sportive zephyr as it passes by, and again return to them when the sun has reached its zenith—when the dews of heaven no longer rest upon their leaves, and when, by the exhalations from their

pores, their watery constituents are well nigh exhausted; and then, in the dimness of their beauty—the shrivelled and irregularly folded leaf—the drooping head and bending stem, will you behold the importance of this agent, and readily acknowledge its presence a necessary vital stimulus to plants.

Again turning our attention to man, behold him sweating beneath the vertical sun of a tropical clime, or dissipating his fluids by active exertion beneath a more temperate sky—mark the subsequent dryness of his lips—his parched tongue—his rapidly increasing, and, at length, irresistible desire for drink; and then administer a glass full of water—repeat this—observe the immediate subsidence of his feverish symptoms, and you will at once acknowledge the influence of water, and view it as the natural beverage of man.

In this light, then, it is evident that, when the body is in health, and when the digestive organs are competent to perform their functions, no stronger fluid than this is required to assist the process of digestion, and that he who adheres to this plan, will, provided all other things be equal, not only preserve his health, but enjoy a uniform vigour of mind which is incompatible with the free use of stimulating drinks. Water, however, requires a proper discrimination in its use; for if taken in too large a quantity at once, it dilutes the gastric juice, and thereby chemically retards digestion; whilst its over-distension of the coats of the stomach interferes with the action of this organ, and thus mechanically impedes this necessary

process. In moderate quantities, taken at proper times, it repairs the loss which has been sustained by the watery part of the blood in the maintenance of the various exhalations and secretions—it acts as a solvent to some, and as a menstruum to most alimentary substances—and, thirdly, by some writers it is regarded as a nutritive agent.

When soft, or free from saline constituents, it is a better solvent of both animal and vegetable food than is hard water; but this advantage confers on it the property of more quickly becoming impregnated with lead from leaden pipes and cisterns than the latter. Rain and distilled water intended for any dietetical purpose, ought, therefore, never to be kept in such vessels; nevertheless its corrosive action on the lead is greatly impaired by the addition of common salt, or a quantity of the sulphate of soda. As a nutritive agent, the action of water is but little understood; nor has any rational theory yet been advanced by even the supporters of this opinion; but looking at its chemical composition of one atom of oxygen united to one atom of hydrogen, it is not improbable that it enters into combination with some of the alimentary principles, increases their bulk, and thus takes part in the formation of the tissues. It is, however, highly necessary that, for the accomplishment of any beneficial object, it should contain no decomposing organic substance, or other noxious principle; otherwise it would act injuriously on the system, by probably giving rise to inflammation* of the lining

* Putrescent vegetable matter frequently gives rise to dysentery.

membrane of the large bowel, or to other diseases which are incident to the peculiar poison.

By allowing a little toasted bread to infuse in water, the latter acquires a pleasant and an agreeable flavour, which is owing to the extraction of an empyreumatic matter, and with which a small proportion of gum is derived from the toast, thus imparting to the water a nutritive property.

By admixture with tea, coffee, cocoa, chocolate, and chicory, a highly agreeable drink is procured in each instance, which is extensively used by all classes of society, and which, contrary to the generally received opinion, certainly imparts a degree of nutriment to the system. Thus by analysis a hundred parts of tea are found to contain of

	Black.	Green.
Tannin	40.6	34.6
Gum	6.3	5.9
Woody fibre	44.8	51.3
Glutinous matter	6.3	5.7
Volatile matter and loss	2.0	2.5
	100.0	100.0

Now, the gum, gluten, and lignin of the woody fibre herein contained, being so many alimentary principles, tea is, therefore, to be regarded as containing nutritive properties; but these are probably in so small a proportion in the infusion, as to render them almost inappreciable by the system.

Tea nevertheless possesses other properties, which manifest themselves by constringing the bowels—by a sedative influence on the heart and arteries—and

by exerting a peculiar action on the nervous system, and thus diminishing the tendency to sleep. In some instances, a strong infusion of green tea has been known to produce very unpleasant symptoms, accompanied by a degree of narcotism or stupor, the cause of which, by a continued action on the nervous system to a much less extent, ultimately impairs its functional activity, and thereby lays the foundation for subsequent disease. The astringent effect of tea is clearly referrible to the tannin which it contains; but its action on the nervous system is not so evidently dependant on any ascertained constituent; although it may possibly depend on the presence of the Tea Oil of Thomson, or the crystalline salifiable base (theina-caffein) of Jobst and Oudry.

To the presence of the latter, coffee undoubtedly owes its exhilarating properties; while its nutritive effects are to be ascribed to the gum, fixed oil, lignin, and albumen which it contains. The last mentioned two of these alimentary principles, together with the addition of sugar, impart to chicory its nutritive properties, which, in the case of cocoa and chocolate, and especially in the latter, are in part derived from the presence of an oil, which renders them difficult of digestion.

A similar opinion to that which exists in the minds of some persons, respecting the alleged impossibility of these substances to take part in the formation of the organism, likewise prevails, as regards the use of malt liquors; and so long and violent has been the discussion between the advocates of each opinion,

that the subject, although interesting in itself, and of easy approach in the first instance, has, at length, become so overloaded with unscientific speculations and posthumous opinions as to render it an extremely delicate point for induction to touch.

In all such cases, however, a truly philosophic mind will cast to the winds all hypothetical notions and unjustifiable assertions, and fearlessly base its judgment on the inductions of science and the results of daily experience. Hither, no *ignis fatuus* leads the way. Hither, imagination directs not her flight; but truth extends her ample wings, and reason and common sense acknowledge her sway. While, therefore, universal experience attests the compatibility of sound health with the temperate use of malt liquors, science asserts their nutritive qualities in the detection of gum and gluten, and a tonic property in the active principle, or lupulite of the hop. Of the good effect of these no reasonable doubt can be entertained; but to this assertion is affixed the important question—whether or not such effects are counterbalanced by the alcohol which malt liquors contain. On this one point hinges the value of such drinks; but to determine it satisfactorily it would be necessary to ascertain the proportions of gum, gluten, and alcohol, in a given quantity of ale, beer, and porter, and to fix the relative value of the first two to the system, as well as the injury which the last is capable of inflicting on the tissues. Now, the quantity of gum and gluten is indirectly indicated by the increase of specific gravity of ale, beer, or porter, over that of

water; but this means does not furnish us with the absolute quantity of these substances present, inasmuch as they are associated with the lupulite of the hops, with a small proportion of tannic acid, brown extractive matter, and the phosphates of lime and magnesia, all of which add to the specific gravity of the fluid. Without making any necessary deduction for these, and by fixing the specific gravity of water at 1,000, it is found that that of the best Burton Ale varies from 1.111 to 1.120; of Porter from 1.050 to 1.055; and of small beer from 1.014 to 1.033, or 1.039.

Allowing three sevenths of this overplus as the representative of the gum, gluten, and lupulite, it is hence inferred, that the amount of real nutritive matter is so trivial as to be almost inappreciable by the system, and to all but exclude ale, beer, and porter from the list of nutritive aliments. To counterbalance this trifling good, the above-named ale yields, on an average, 6.87 per cent. of alcohol—London Porter 4.20 per cent.—and small beer 1.28 per cent., and the action of this, when duly considered, will, if we regard alcohol, in the smallest quantity, as injurious to the system, balance the beam, if not turn it against the nutritive constituents. I am not, however, disposed to view alcohol as having this effect in every instance; because it is a well ascertained fact, that the nervous system admits of a certain degree of stimulation without experiencing a subsequently corresponding diminution of its healthy action, and that alcohol, in a state of free dilution, is incapable

of coagulating the albumen of the food or of the tissues, and consequently of producing any injurious effect on the organism. In a more concentrated form, or when frequently repeated so as to accumulate in the system, it proves a direct irritant to the parts with which it comes into contact, and owing to its great affinity for water, this it extracts from the tissues—increases the density of their solid albumen and fibrine—impairs the function of organs —and excites in them a chronic inflammation, which may lead on to organic disease, as of the stomach, liver, brain, kidneys, &c. But when taken in a diluted state, as in ale, beer, or porter, its chemical action on the tissues is obviated, and its stimulant effect on the nervous system being within the range of healthy action, not only is the function of the digestive and assimilative organs promoted, but the system reaps the full advantage of the nutritive constituents of the drink. Notwithstanding this, it is evident that, in a state of health, no such stimulus is required by nature ; but when a person has undergone great bodily fatigue, although no actual disease is present, yet the vital energy of the system is, for the time being, so far reduced as to be greatly benefitted by a moderate use of alcoholic drink. It is on this principle, then, that I would recommend its occasional use—not as an essential, but as a restorative, when from any cause the action of the nervous system is below par.

Although I conceive the temperate use of malt liquors to be admissible even with persons in good

health, I would, nevertheless, proscribe the employment of ardent spirits, except in a state of extreme dilution. So great, indeed, is the proportion of alcohol which each of these contains, that more injury than good is apt to accrue to the system by even their sparing use, and for this reason, he who puts them altogether aside, will never experience a moment's regret at their loss. If we reflect that Brandy contains 55.39 per cent. of alcohol, Scotch Whiskey 54.32, Rum 53.68, and Gin 51.63 per cent., and that with the exception of a small proportion of sugar in the Rum, not one of them possesses a single nutrient particle, we see good reason why their employment should, as a general rule, be entirely abandoned.

A similar opinion to this may likewise be expressed of Wines, which, nevertheless, contain a far less proportion of alcohol than do ardent spirits ; whilst the presence of sugar and gum certainly imparts to them a slightly nutritive property. But this is to so small an extent as to render it unworthy of our attention ; whilst the amount of alcohol which the different varieties contain, is such as to demand our serious consideration. Thus, according to the experiments of Dr. Christison, the proportion per cent. by weight was found to be for

PORT.

	Parts of Alcohol.
Weakest	14.97
Mean of 7 Wines	16.20
Strongest	17.10

SHERRY.

	Parts of Alcohol.
Weakest	13.98
Mean of 13 Wines, excluding those very long kept in cask	15.37
Strongest	16.17
Mean of 9 Wines, very long kept in cask in the East Indies	14.72
Madre da Xeres	16.90

MADEIRA.

ALL LONG IN CASK IN EAST INDIES.

Strongest	16.90
Weakest	14.09

Teneriffe, long in cask at Calcutta	13.84
Cercial	15.45
Dry Lisbon	16.14
White	14.97
Shiraz	12.95
Amontillado	12.63
Claret, a first growth in 1811 ...	7.72
Chateau-Latour, first growth of 1825	7.78
Rosan, second growth of 1825 ...	7.61
Ordinary Claret, a superior *vin ordinaire*	8.99
Rivesaltes	9.31
Malmsey	12.86
Rüdesheimer, superior quality ...	8.40
Ditto, inferior quality ...	6.90
Hambacher, superior quality ...	7.35

In addition to alcohol, sugar, and gum, the constituents of Wine are—volatile oil, blue colouring matter of the husk (in red wine,) yeast, bitter extractive, tannin, acetic, malic, tartaric, paratartaric, racemic, and carbonic acids, the bitartrate of potash and of lime, sulphates and chlorides, together with phosphate of lime and water. According to the variable amount of these constituents, wines are termed red, white, sweet, acidulous, light, rough, sparkling, dry, strong, &c. Hence Malaga, Tokay, Tent, Frontignac, Canary, Constantia, Shiraz, and Malmsey, are, from their excess of sugar, termed sweet ; the Rhenish, Moselle, and Claret, acidulous, indicating an excess of acid ; while, owing to their comparatively small proportion of alcohol, they, together with Hock, Mayne, Barsac, and Hermitage, compose the principal light wines ; and Port, Madeira, Sherry, and Marsala, from an opposite cause, the strong. By keeping, all Wines deposit bitartrate of potash, (cream of tartar) extractive and colouring matter, which are apt to disagree with some persons, and, on this account, old wines are to be preferred.

In every instance, due regard should be paid to the age, colour, alcoholic strength, intoxicating property, sweetness, and the quantity of acid present. The deeper the colour the greater is the amount of extractive and colouring matter present in the wine, and the more difficult is it of digestion. This ratio of effect, however, does not hold good with respect to the quantity of alcohol present, inasmuch as Champagne, notwithstanding it contains a less proportion

of spirit than Port Wine, is more intoxicating than the latter.

Again, the sweeter the wine, the more indirectly nutritive matter it contains; but this, in a diabetic state of the system, would prove exceedingly injurious, and should, therefore, be strictly avoided by all such persons. A similar remark is applicable to the use of acid wines, which, in acidity of the stomach, gout, rheumatism,* and certain urinary deposits, are highly injurious; whilst in urinary deposits of a phosphatic kind, their exhibition might be attended by advantage. Let me, however, impress on your mind my firm conviction, that health requires no other stimulus than that of the natural aliment, and that the more such excitants as wines are avoided, the longer will the system withstand the occurrence of disease, and when overtaken by it, the more effectually will it bear up under its influence.

Little further needs be said in reference to drinks and liquid foods, except that Lemonade, Soda-water, Ginger-beer, and such like drinks, although pleasant and agreeable to the taste, interfere with the process of digestion by distending the stomach with gas—that broths are nutritive in proportion to the quantity and quality of the meats from which they are made, and more or less digestible according to the quantity of fat which is present—and that gruel and barley-water are not only bland and easy of digestion, but contain a considerable amount of nutriment.

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* A small quantity of either wine, spirits, or malt liquor, will, at any time, bring on an attack of rheumatism in the writer.

Amongst condiments are ranked common salt, vinegar, thyme, sage, nutmegs, caraway-seeds, horse-radish, onions, garlic, oil, butter, sugar, honey, treacle, and various sauces. Of these, salt is by far the most important, as well as the most useful—nay, so essential is its presence in the economy, that, were it to cease to exist, health could no longer be maintained. This remarkable property it manifests by its being an essential constituent of the blood—by its undergoing decomposition in the system, and by the subsequent arrangement of its chlorine with hydrogen, in the form of hydrochloric acid, which becomes a necessary constituent of the gastric juice—and by its repairing the loss which the blood is constantly sustaining in the maintenance of the secretion of bile, tears, &c.

But although such is the case, there is a certain limit of quantity in just balance with healthy action, and its extension beyond this is alike injurious to the tissues and to health. How nicely adjusted is nature! How great our dependence! How nearly equipoised are life and death! By links like this, creation's works are joined—unity of purpose is established—Eternal Wisdom shines forth—and order pervades the universe.

Next in point of value to that condiment which has thus called forth these reflections, is vinegar, the use of which is either alone, or in the form of pickles. In either state it is generally admissible, and from its exerting a stimulant action on the stomach, together with the property of dissolving albumen, fibrine, and gelatine, it very probably accelerates the process

of digestion. But its use is neither to be indulged in too frequently, nor in too great a quantity at once; for not only in this way does it produce the absorption of fat, but it likewise induces that peculiar condition of the system which gives rise to the evolution of consumption.

Of most of the other condiments, with the exception of the pungent and aromatic kinds, notice has, in some form, already been taken; and of those now specified, it is only necessary to remark, that they are employed for their flavour, and as an agreeable stimulus to the function of digestion.

LETTER VIII.

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Thus, from a variety of classes of both animals and plants, our aliment is derived, and though, in the first instance, its nature be dissimilar to ours, yet, by the action of the various digestive and assimilative organs, it readily undergoes that necessary transformation which adapts it to the various purposes of nutrition. In this manner plants become animals; and these, by various secretions emitted from their living organism, re-enter the vegetable structure, and again become plants. In the eternal revolution of matter not a particle is lost; but every grain and every atom, though they undergo a thousand transformations, and assist in the structure of bodies of a dissimilar nature, complete with admirable precision the sum of their dependencies, and contribute to the grandeur of the universe. By this incessant transformation life and death are maintained—being after being springs up—plant after plant bursts forth, all doomed to an indefinite term of existence, and after that, again to swell the great cycle of change.

From the very moment of their existence as separate beings, they appropriate to themselves certain

kinds of nourishment, which, after being subjected to the action of various organs, are so far assimilated to their nature as to take part in the formation of the organism. In vegetables and the lowest class of animals these objects are accomplished without the existence of a stomach for the reception of unassimilated food ; but, in man and the higher animals, such an apparatus seems essential to their existence, inasmuch as their faculty of locomotion "precludes the possibility of their continual adaptation to the reception of solids and fluids from without."* But, previously to the reception of all solid food into this organ, it has to undergo a certain preparatory process by the action of the teeth and saliva, by which it is greatly comminuted and moistened, and is then collected on the dorsum of the tongue, thence, by certain voluntary muscular movements, to be passed backwards into the throat, along which it gradually descends into the stomach. No sooner has this action been completed, than the stomach, sensible of the stimulus which it has received, allows a peculiar acid secretion to distil from its erected villi,† by which a chemical change is wrought on the food, and thus effects its conversion into a soft, homogeneous mass. This conversion of the food into chyme is due only in part to the chemical action of the acids (lactic and hydrochloric) contained in this secretion, since numerous experiments by Eberle, Muller, and

* See Alison's "Outlines of Physiology."

† Villi is the name given to the small tufted projections which are seen on the inner surface of the stomach and bowels.

Schwann, have distinctly proved the existence of a soluble animal principle, termed pepsin, in the lining membrane of the stomach, which exerts a solvent action on the aliment, and especially on that of a fibrinous or albuminous nature.

The time occupied in effecting this first process of digestion, varies with the nature of the aliment and other circumstances ; but, with regard to vegetable and animal substances, it may be remarked, that the latter, although more easy of digestion than the former, are, as a general rule, longer retained by the stomach* ; and that, in all cases, digestion is, in the first instance, favoured by rest, which acts by increasing the flow of blood to the lining membrane of the stomach. It is further ascertained that the whole mass of food is not uniformly and at once submitted to the action of the gastric juice ; but that layer after layer is presented to it, which, after undergoing the necessary change, is gradually propelled onwards to the bowels by a peristaltic action of the muscular fibres of the stomach.

In this stage of digestion it has been shown, by the microscopical examinations of Leuret and Lassaigne, that the chyme contains a number of globules, which resemble those of the blood, except in their being of smaller diameter, and which manifest the same tendency to arrange themselves into fibres ; but it does not appear that the chyme contains any real albumen, unless this has formed a part of the food, and, in this

* See Londe, in Archives de Medecine, tom. x.

respect, it is at variance with the chemical nature of the blood.

After passing the stomach, it is admitted into the first portion of the small intestines, in which it mingles with the bile from the liver, the pancreatic juice, and the mucus, or natural secretion of the bowels, by which it is converted into a somewhat milky fluid, called chyle. This possesses none of the acidity of the chyme, for the bile, being of an alkaline nature, neutralizes the acidity of the former, and by a portion of its alkali uniting with any oily article of the food, the above-named milky colour is supposed to be produced. At this stage of digestion, albumen can be detected in the contents of the small bowels, and the organic globules of Leuret and Lassaigne likewise exist in greater number than in the chyme of the stomach. In this condition the chyle separates from the refuse matter, which, uniting itself to the bile, passes on to the large intestine, thence to be expelled from the system; whilst the former is absorbed from the inner surface of the small intestines by certain vessels termed lacteals, which thence convey it through appropriate glands into a large duct running along the anterior surface of the spine, and emptying itself into the torrent of the circulation at the angle formed by the union of the large vein of the left side of the neck with that of the corresponding upper extremity.

Now, during the passage of the chyle along these vessels, its organic globules become more and more numerous—its albumen more distinct—and, in its

still closer approximation to the blood, a little fibrine appears, which imparts to it the property of coagulating on exposure to the air, after the manner of that fluid. Having entered the current of the circulation, it passes directly to the heart, and is thence propelled forwards to the lungs, in which it undergoes the last change in its conversion into blood, which thus becomes the source of nutrition to all parts of the system. The blood, then, being the source whence our bodies derive their nourishment, and by which life itself is maintained, it follows, as a necessary corollary, that health depends on the purity of this fluid, which purity is determined by the nature of the food and the perfect action of the digestive and assimilative organs. This action, again, is greatly influenced by means within the power of every individual; but these, for the present, are left in abeyance to notice the peculiarities of the blood.

This vital fluid, on being drawn from a vein, is of a purplish red colour; but, after being exposed for some time to the action of the air, it separates into a dark coloured *clot* or *crassamentum,* and a somewhat yellowish fluid, called *serum,* in which the former is suspended. Hence we have two distinct parts, which, in their combined state in the vessels of man and the higher animals, compose an adhesive fluid—of a homogeneous consistence—of a slightly saline taste —of the specific gravity of 1.050—and of the temperature of 98°.

Various estimates have, at different times, been formed, respecting the relative proportions of these

two parts of the blood ; but all of them are more or less fallacious, in consequence of the separation's being incomplete, and also from the fact, that the proportions are not the same in different individuals, as well as in the same individual at different periods. Perhaps the nearest estimate is that which fixes the relative proportion of the serum to the clot as two to one. If, therefore, the whole mass of blood, in the adult human subject, is twenty-seven pounds, of these, eighteen pounds are serum, and nine crassamentum or clot. The latter, by microscopical examination, is found to consist of a number of filaments interlacing each other in every direction, and entangling in their meshes a quantity of red globules, on which the colour of the clot depends. These filaments depend on the presence of a coagulated fluid, which, in its nature is truly elastic and tenacious, and which, in its aspect and chemical relations, resembles the pure fibrous structure of muscles, yet, with respect to its organization, its identity may certainly be doubted. It is of a pale, fleshy colour, and has, by different authors, been variously denominated coagulable lymph, gluten, fibrine, and fibre of the blood. On this the formation and consequent separation of the clot from the serum depends. By an effusion of this from the vessels, and its subsequent organization, the lips of wounds are drawn together, and the injured textures thereby healed.

Besides this constituent of the clot, the latter is, as just stated, partly composed of a number of red globules, the nature of which has been the subject

of frequent investigation. Without, however, any regard to physiological speculations or controverted opinions, it may be stated, that each globule is generally thought to consist of a nucleus, or nuclei, enclosed within a vesicle of a spherical figure distended with fluid ; and that, to the circumstance of its containing the oxide of iron, must be ascribed the existence of its colour. On this latter fact it is maintained by Liebig, that the red globules are the carriers of oxygen, which they absorb in the lungs, and give out in the capillaries, or terminal vessels ; and that by this alternate oxidation and deoxidation of the iron, the constant temperature of the lungs and body is maintained.

In addition to these globules, others of a colourless nature and of a larger size, together with small granules, compose, in part, the solid portion of the blood ; but whether they represent the different stages of the same growth, or separate and distinct formations, it has not yet been ascertained ; nor would it be profitable to prosecute the inquiry any further in this place.

I, therefore, proceed to state, that the *serum* is a transparent, homogeneous fluid—of a light straw colour—of an adhesive consistency—and of the specific gravity of 1.027—1.030. When exposed to a temperature of 160°. a large coagulum of albumen appears in it, from which a fluid may be expressed, holding in solution a small proportion of an animal matter, termed *muco-extractive*, together with soda, or its subcarbonate, sulphate of potash, chlorides of

sodium, (common salt) and potassium, and the phosphates of lime, magnesia, and iron.

From these facts, contrasted with our knowledge of the constituents of the different textures, it appears that most, if not all of the materials of the body, circulate in the blood in a fluid form, and that to complete its destined purpose, the latter must necessarily traverse every structure, and permeate every tissue from the compact, dense structure of the osseous system to the loose, flocculent, cellular web, depositing in its course the ultimate materials for the molecular formation of every part. This, therefore, it does by the agency of the heart, arteries, and veins, which carry on the circulation, and for which purpose the last two are everywhere distributed through the system.

The heart being the central organ of the circulation, it is divided into four cavities, from the lower two of which the arteries arise by two trunks, and into the upper two of which the veins pour their blood after it has served its purpose in the system, and also after it has been renewed in the lungs.

In illustration of this process, we may suppose the large veins to be discharging a portion of their effete, or black blood, into the right upper chamber of the heart, whence it passes through a valve (tricuspid) into the lower chamber, which, after becoming distended, contracts and forces its blood into a vessel, called the pulmonary artery, by which it is conveyed to the lungs, where, on being exposed to the air contained in the cells of those organs, it absorbs a portion

of its oxygen, which converts it into red or arterial blood. This being received by the veins, which are everywhere continuous with the arteries, is returned to the left upper chamber of the heart, whence, as in the former instance, it passes through another valve (mitral) into the corresponding lower chamber, which afterwards ejects it into the great systematic artery, by which, through its division into innumerable smaller branches, it is carried to the most remote parts of the frame, and subsequently returned by the veins to the point whence it set out. From this fact, and by regarding the heart as the point whence the blood sets out, it is readily perceived that it performs two circulations, one of which through the system, is for the healthy preservation of the body and the due maintenance of the functions of life; whilst the other, through the lungs, premises a renovation of its ultimate materials, and a necessary increase of its vivifying principle.

These prospective contrivances are at once simply, wisely, and most beautifully effected in the manner which is here described. Yes, they very mutely, yet forcibly attest the existence of an Artificer, whose conception is unbounded—whose wisdom is beyond mortality—whose execution far surpasses human invention, or the greatest stretch of the strongest mechanical mind. Notwithstanding the vast—the sublime attributes of the Deity—and the apparent insignificance of those with which the mortal mind is endowed, great and merited praise obtains to that person by whom even one seemingly hidden path of

Omniscience is discovered, in which His imperishable footstep is exhibited amidst the overwhelming shadows of celestial light. Influenced by this conviction, I feel it no less a pleasure than a duty to avow my reverence for the name of the celebrated Harvey, who by his brilliant discovery of the circulation of the blood, subverted the doctrine of ancient superstition and credulity—of popular ignorance and bigotry—and thus conferred an everlasting boon on the whole human family. From the earliest ages of medical science to that period, it was universally believed, that the blood flowed in a certain direction through the vessels during the day, and pursued a retrograde path during the hours of sleep. Thus inert, observation was, for age upon age and century after century, lulled to lethargy in the arms of presumptive ignorance, whilst the banner of hypothetical belief and arrogant superstition flaunted over the irresistible stream of popular opinion, till at length the signal was given for their total subversion, and the speedy dispersion of mental darkness by the dawning beam of an intellectual day. Shortly after this, the sun of knowledge proudly and majestically appeared above the murky horizon of medical science, and although its effulgent beam was for a time intercepted by the tenebrious mist in which the mental world was enshrouded, it still continued its upward course in the heavens, till, from its meridian height, it no longer shone upon a single vestige of its recent pall, but with meteoric splendour, shed a lasting halo around the head of its illustrious discoverer.

But to return more particularly to my subject. The blood, enriched with a quantity of organizable matter, traverses the whole arterial system to the commencement of that of the veins, without undergoing any change. Here the extreme arteries allow a portion of it to permeate their coats and to escape into the texture of surrounding organs, where, after being acted upon by the principle of life, it becomes organized and forms a part of the living fabric.

Now, according to the doctrine of *cytogenesis*, or growth from cells, this process of organization presupposes the existence of a granular fluid, or *cytoblastema*, in which the nutrient elements exist. By the union of two or three of these granules, or the formation of a corpuscle in which one or more are enclosed, a nucleus is formed, from the surface of which a transparent vesicle arises, thus constituting a nucleated cell. This being impressed with vitality, a species of vital imbibition, or endosmosis, is exerted on the surrounding blastema, which leads to the enlargement of the cell-wall, and to the formation of a fluid between it and the nucleus. In this fluid, other granules, nuclei, and cells are ultimately formed in the same manner as before; and these, by distension of the original cell-wall, cause it to give way, by which means they find an exit from the parent cell. By several of these cells' arranging themselves in line, and by the absorption of their ends, tubes are produced; by their elongating and splitting up, fibres are formed; whilst, by their remaining persistent and a deposition of earthy substances taking place on

their inner surface, the harder structures of the body are evolved.*

Thus does growth proceed by cells—thus is the blood constantly furnishing a blastema for this formative process. Health, therefore, depends on the condition of this fluid; this again depends on the nature of the food and the action of the digestive and assimilative organs, and this action is greatly influenced by the digestibility of the food—by air, exercise, cleanliness, clothing, sleep, and other causes.

In reference, then, to the nature of the food, previous observation has shown, that to maintain health, it must consist of a plastic element of nutrition, and a supporter of respiration; or, in other words, a nitrogenized element, to assist in the formation of the tissues, and a carbonized element, to prevent their consumption, by combining with the oxygen taken into the lungs during the process of respiration, and the evolution of animal heat.

On reference to the alimentary principles before given, it is at once seen, that the nitrogenized, as albumen, fibrine, caseum, gelatine, and osmazome, are derived from the animal kingdom; and that gluten is the only nitrogenous principle furnished by the vegetable kingdom, which, nevertheless, abounds in the carbonized, as sugar, gum, starch, lignin, and vegetable jelly. Liebig, however, maintains, that albumen pre-exists in the food of the herbivora; but the experiments of Dr. Prout disprove the truth

* See Bennett's "Treatise on Inflammation as a process of Anormal Nutrition."

of this opinion, by clearly demonstrating that albumen cannot be detected in the contents of the stomach of such animals, and that its formation does not take place until after the food has passed into the small bowels. I, therefore, fall back on my previous statement—that gluten is the only nitrogenous principle derived from the vegetable kingdom; and from this it is inferred, that for the nitrogenized principles we are chiefly indebted to the animal kingdom, and for the carbonized, to that of the vegetable. Hence, the tissues are most plentifully formed from animal food; whilst respiration and the consequent evolution of animal heat are best supported by a vegetable diet. When, with animal food, a due supply of fat is taken, all the objects of nutrition are effected without recourse to a different kind of aliment; and when again, a proper quantity of gluten exists in a vegetable diet, the absolute necessity for animal food is abolished.

Life, then, can be maintained by either a vegetable or an animal aliment; but experience—the requirements of the system—and the ultimate constituents and derivation of the alimentary principles, seem to prove, that a due admixture of both is the best adapted to our nature and to the maintenance of health.

In promoting this, the object should always be—to produce a healthy condition of the blood at the least expense of the digestive and assimilative organs; and, with this view, those foods which contain the greatest amount of nutriment and require the least

digesting, should, as a general rule, be employed.

Now, the amount of nutritive matter, as well as the mean time of digestion of various articles of food, has been before given, and reference needs only to be made to these, to determine the relative value of each in common use.

As various articles of unequal digestibility compose the different meals, these require to be proportioned to the varying power of the stomach ; and, as this has been before shown to be at its highest tension in the morning, so also should the food, taken at that period, require more digesting than at any other part of the day. In this way the digestibility of the food is proportioned to the action of the digestive organs, the advantage of which over the indiscriminate use of aliments, is at once evident.

This saving of functional power is further increased by a proper mastication of the food, and by due regard to its repetition and quantity. If it is imperfectly masticated, or too frequently repeated, or in too great a quantity at once, a greater amount of labour is thrown upon the stomach ; and this organ, obeying the general law—that no organ can be engaged in one kind of action beyond a definite period without experiencing a loss of its nervous energy and thereby of functional power, is at length rendered incompetent to its task, the result of which is—a deteriorated condition of the blood, and a consequent decline of the health. To avoid this, the food should be well comminuted by the teeth—its quantity moderate—and its repetition not oftener than twice a-day ; nor

should much liquid be taken with solid food, since by over-distending the stomach, and by diluting the gastric juice, it interferes with both the mechanical and chemical process of digestion. By rest of both body and mind directly after eating, this function is greatly accelerated, for the food, acting as a natural stimulus to the nerves of the stomach, these, by a kind of reflex action on those of the vascular system, increase the flow of blood to the lining membrane of that organ, and thus augment the functional activity of the latter.

When the process of digestion has been completed, it is necessary that the stomach should, like every other organ, enjoy a period of repose; and as a solid meal is full three hours in reaching the small bowels, and as every function of the body is but slowly performed during sleep, it seems requisite that an interval of five hours should take place between each repast, and that the last meal of the day should be taken at least three hours before retiring to rest. If, then, five hours be allowed as the stated interval between meals, and if to these we add eight more for the perfect renovation of the body by sleep, it will be found that the natural wants of the system require but three meals per day, and that frequent repetition of food is highly injurious.

Food, notwithstanding however wisely chosen, however easy of digestion, or great its adaptation to the system, is, of itself, insufficient to maintain the health and vigour of the body without a liberal supply of fresh air. This condition in man imposes the

necessity for the existence of certain organs termed lungs, into which the air may penetrate and produce that ultimate effect on the organism which is essential to life and health. But air being a compound of

	Parts.
Azote	788
Oxygen...	197
Steam	14
Carbonic Acid	1
	1000

it is found, that the effect produced on the system is due to the presence of oxygen, and that the affinity of this gas for the tissues is so great as to require its dilution with azote ere it can be safely introduced into the lungs. It is not, however, on the tissues, but on the blood that its first effect is produced ; for this fluid, after having served the purpose of nutrition in the ultimate organism, becomes impregnated with carbonic acid, which is poisonous to the system, and with which it returns to the lungs, there to effect its disengagement by the oxygen inhaled during the process of respiration. During this chemical change, the liberation of the carbonic acid is effected, together with watery vapour in the form of breath, and the oxygen respired uniting itself to the red globules of the blood, this fluid passes from a deep purple to that of a bright vermilion colour, and is again fit for its office in the system.

Yet must it be understood, that not only do I believe carbonic acid and watery vapour to be lib-

erated in the lungs, and to be produced in the ultimate texture of those organs, but also to be generated in their capillary vessels, by the union of the oxygen of the air with the carbon and hydrogen of the decomposed carbonaceous principles of the food. Now, as the union of oxygen with carbon cannot take place without the evolution of heat, we should, at first sight, expect that the temperature of the chest would rise considerably higher than that of the extremities ; but when we take into consideration, that a large quantity of heat becomes latent in the vaporization of the water exhaled at the lungs, and that the arterial has a greater capacity for caloric than has venous blood, there is offered a sufficient explanation of the fact, that the temperature of the chest is but several degrees higher than that of any other part of the body.

Were there not this direct formation of carbonic acid and the consequent evolution of heat by the union of a portion of the inspired oxygen with the carbonaceous elements of the food in the capillary vessels of the lungs, the temperature of these organs must fall considerably below that of any other part of the body, in consequence of a part of the animal heat generated in their ultimate texture, being abstracted in the vaporization of the water exhaled at their mucous surface. It would hence appear, that carbonized foods, by their direct combustion in the lungs, *indirectly* keep up the animal heat, and that the uniform temperature of the body is *directly* maintained by the formation of carbonic acid in the ultimate texture of the lungs and other organs, owing

to the chemical affinity of the oxygen of the blood-globules for the carbon and hydrogen of the old molecules of matter overcoming the vital attraction which has hitherto held them in "*static equilibrium.*" Hence two opposing forces are constantly in operation —the one a vital and the other a chemical—the former effecting the nutrition of the body, the latter its waste. The more rapidly waste proceeds, the greater is the demand on the nutritive power, and the more effectually this requirement is met, the more rapid is growth, and the better the condition of health and strength.

By increasing, therefore, the amount of oxygen taken into the lungs, we promote the decarbonization of the blood, and thereby get rid of a principle which were certain death if retained in the system in any great quantity ; but by thus replenishing the blood with oxygen, we again restore to it the means of acquiring carbonic acid after it has fulfilled the purposes of nutrition in the organism. Thus do life and death, as it were, alternately take possession of the same globule of blood, and the supporter of the former ultimately becomes the generator of the cause of the latter. Still our object is to introduce as much oxygen as possible into the system, for on its presence the life and energy of the body depend. Now, the composition of the air is everywhere the same ; but its density varies according to its temperature ; therefore, the less its expansion by heat, the greater the amount of oxygen present in a given volume. Hence the colder the atmosphere the more oxygen enters

the lungs, for the capacity of these organs always being the same, similar admissions must take place under like circumstances. When, therefore, more oxygen is to be introduced into the system in a given temperature, the number of inspirations must be increased, otherwise this object cannot be attained.

In healthy adults the average number of inspirations is eighteen per minute, and the quantity of air inhaled during each, forty cubic inches; but by quickening the circulation and increasing the functional activity of the lungs, inspiration may represent twenty-eight, in accordance with which the increase of inspired oxygen will observe a corresponding ratio, and thus the waste and temperature of the body will proceed more rapidly than before. To compensate for the loss thus sustained, the activity of the vital force is roused—the appetite is increased—a due supply of carbon, hydrogen, and nitrogen is taken in the shape of food—the demands of respiration are thereby met—and nutrition keeps pace with the destructive action of oxygen in the ultimate tissue. But oxygen, although in itself a destroyer, is nevertheless a supporter of life and health when a due supply of food is taken, for not only does it burn up in the lungs the unassimilated carbonized elements of the food, but by entering into combination with the carbon and hydrogen of the old and, as it were, worn-out particles of the body, it promotes their removal in the various exhalations and secretions, and thus favours the deposition of more active molecules of matter.

Oxygen, therefore, is as essential to health as food.

Hence the almost incalculable value of exercise in promoting respiration and circulation, and the important necessity for avoiding warm rooms, crowded apartments, the use of stays, or any other chemical or mechanical cause which interferes with the introduction of this agent into the system.

So great and so general is the injury inflicted on the female part of the community by the wearing of stays, that their use cannot be too severely reprobated. In the natural conformation of the chest it invariably represents a cone, the apex of which is at the root of the neck and the base below; but from the constant and gradual compression exerted on the lower ribs by the artificial means of stays, this natural order is reversed—the apex now being below and the base above. The effect of this is to lessen considerably the quantity of air entering the lungs during each inspiration, and to, probably, reduce it from thirty-eight or forty to twenty-eight or thirty cubic inches, in consequence of which the blood is imperfectly decarbonized—the change of matter in the ultimate tissue proceeds but slowly—the appetite is poor and vicarious—nutrition is imperfect—and a weak and puny state of the system induced.

Owing also to the partial inactivity of the respiratory muscles by which, in healthy respiration, the lower ribs are elevated and their inferior borders everted, and to the imperfect inflation of the lower portions of the lungs, the upper portions, by a compensatory act, become greatly distended with air

during each inspiration ; but this being a forced effort of nature, it renders these organs peculiarly liable to disease, and hence the prevalence and fatality of pulmonary complaints in young females. In consequence too, of the diminished capacity of the chest—the compression of the lower ribs—and the encroachment on the heart, liver, and stomach, functional disturbance, congestions, and inflammations of these organs ensue, by which the constitutional powers are subverted, and the lives of many unhappy victims brought speedily to a close. If, then, a sound constitution is to be acquired, such articles of dress should be cast aside ; neither should the automatic movements in seminaries, nor the strained positions of the body at the writing or drawing table be long enforced, since they more or less interfere with those natural actions of the respiratory muscles on which health greatly depends.

At every opportunity fresh air should be sought, and if the body be constantly kept in motion, no matter whatever the nature of the weather may be, so great an amount of animal heat will be generated as to fortify it against the bitterly biting frost, the piercing blast, or the "pelting of the pitiless storm."

In cold weather, walking, gymnastic, or equestrian exercise is far preferable to carriage drives ; for whilst, by the former, respiration and circulation are accelerated, and the quantity of oxygen taken into the lungs, together with the consequent evolution of animal heat, is considerably increased ; by the latter these functions are far less influenced, and the

increase of inspired oxygen is slight, and dependant, in a great measure, on the increased density of the atmosphere ; whilst the body, being surrounded by a colder medium than itself, is constantly parting with its caloric to the circumambient air, till at length its energy and vital resistance are greatly overcome.

When, again, active exercise is taken so that heat is generated in the system more quickly than it is abstracted from it, the overplus of caloric is carried off in the form of sweat, which, in an insensible state, is constantly emanating from the surface of the body, and which consists of water, carbonic acid, nitrogen, lactate or acetate of ammonia, osmazome, and a variety of salts.

The functions of the skin are, therefore, highly important, regulating as they do the temperature of the body, and separating from it substances which, if retained in the system, would prove highly prejudicial to health. From the presence of carbonic acid in the secretion of the skin, it, like the lungs, is found to be a decarbonizing organ, the eliminating power of which is as 120 grains of carbon to 4,273 of the latter within the twenty-four hours. But the action of the skin, being increased by a dry, warm, expanded, moving atmosphere, and diminished by the opposite conditions, it is evident that the exact amount of its exhalation and secretion cannot be determined. If, however, we regard not the quantity but the nature of these, we see great necessity for preserving them in due proportion ; for the skin, acting as a safety valve, must, if its action be arrested,

not only subject the system to the influence of the noxious substances which it is its office to remove from the blood, but throw a greater amount of labour on other analogous organs, and thus increase their liability to disease. Hence a frequent cause of inflammation of the lungs and liver—of cholera and other diseases.

Now, during both sensible and insensible perspiration, a residue of its constituent salts and osmazome is deposited on the skin, and if this be allowed to accumulate, it obstructs the exhalent orifices, diminishes the healthy proportions of the cutaneous secretions, and ultimately leads to disease of some organ. In this way, there is no doubt, one half of the diseases which the Physician is called upon to treat, have their origin.

How essential, then, to life and health are frequent ablutions ; and how narrow the mind of that man who sneers at the alleged efficacy of the hydropathic treatment of disease ! Without advocating its universal adoption to the exclusion of all other remedies, I must acknowledge that, on looking at the functions of the skin—the great inattention that is paid to it by most classes of society—and its frequent cause of disease, the daily application of water, by cleansing its surface, and maintaining a brisk circulation through its minute vessels, is calculated to remove entirely some diseases—to become a powerful auxiliary in the treatment of others—and is an invariable promoter of the health. For this last purpose I would strenuously recommend sponging the whole

surface of the body every morning with tepid or cold water, and to follow it by friction, which will have the effect of at once removing the residue of the perspiration, and of exerting a tonic influence on the system.

The plunge or shower-bath may be safely employed with the same view ; for although the first effect of cold water applied to the whole surface of the body, is to cause a retrocession of the blood towards the internal organs, yet the stimulant effect which is at the same time produced on the heart, excites it to increased contraction, by which the blood is again thrown with great force to the skin, and thus a *glow* or increased feeling of warmth is produced. But the continued application of cold water being a direct sedative, it is necessary that its use should not be extended beyond a few minutes' duration ; and, as its first impression on the skin is proportionate to the temperature of the latter, it is important to bathers to know, that the shock of a cold bath is best withstood when the cutaneous circulation is accelerated and the skin is beginning to perspire. If, then, a person determines to bathe, and if, on reaching the banks of the river, a free perspiration has been induced, he ought at once to go into the water, and by so doing his object will be attained. But if he wait until the perspiration has carried off the whole of the animal heat which has been generated by walking, the consequent depression of the system will render it unable to bear the shock—reaction will, therefore, be imperfect—a sensation of cold will

continue—congestion of the internal organs will take place—and disease will be engendered instead of the health promoted.

It is hence seen that the higher the temperature of the skin the better does it withstand the application of cold water; and as the temperature is augmented by a rapid circulation through its minute vessels, and as this (the circulation) is at its highest standard in the morning, that period of the day is undoubtedly the most appropriate to bathing. Directly after coming out of the water, friction with a coarse cloth should be employed, and the clothes put on, when, if the bath is to be beneficial, the glow will almost immediately appear.

It is, indeed, one great essential in the management of health, thus to cleanse effectually the skin —to maintain a due circulation through its vessels —and to guard against aerial vicissitudes by a proper clothing.

In summer, when the temperature of the air is frequently above that of the body, light coloured clothes should be worn, inasmuch as they possess the property of reflecting radiant heat to a much greater extent than those of a darker colour; whilst, during the winter, bad conductors, as furs, woollens, cottons, silks, &c., should be employed, for the purpose of preventing the animal heat from being too rapidly withdrawn by the surrounding cold air.

In persons, however, of a delicate constitution and peculiar susceptibility of the skin to external impressions, flannel should, at all seasons, be worn next

the latter; for not only during summer does it absorb perspiration, and prevent, in a great measure, the conduction of heat from without; but it likewise in winter prevents the abstraction of caloric from the body, in the manner before stated of non-conductors. "It ought," however, "invariably to be taken off at night, and as invariably to be resumed in the morning. In bed it is unnecessary; it is worse than unnecessary, for it does harm: it then unduly stimulates the skin, and produces a preternatural waste of secretions, and corresponding debility of system—a corresponding liability to suffer from the depressing influences of cold—a corresponding incapacity for resisting its influence. But further; removing this garment during the night relieves it from the scurf and other matters, which it must, during a day's wear, acquire, and so renders it fresh and more agreeable to the sensations of the wearer. Not wearing it at night renders it more effectual in protecting the surface from the cold by day; on the principle, that a great coat is not of the same service to the wearer when out of doors, if he is in the habit of wearing it in the house.*"

With the means now mentioned in the preservation of health, the consideration of sleep is associated, and as by this the exhausted energy of the system is restored, and the body refitted for the due performance of its various functions, it is of some importance to know—that from seven to eight hours' sleep is sufficient for an adult male, and from eight to nine

* Dr. W. H. Robertson's Treatise on Diet and Regimen.

for a female—that children require ten or eleven—and that old people seldom sleep more than six or seven.

To promote sleep, a due quantity of exercise should be observed—no food ought to be taken for at least three hours before retiring to rest—the bed-room should be high, spacious, and well ventilated—curtains and chimney-boards should be abolished—the bed hard—and the clothes light and just sufficient to preserve a due degree of warmth ; nor should plants be allowed to remain in the room during the night, since by the absorption of oxygen, and the exhalation of carbonic acid, they render impure the atmosphere on which the vital function of respiration depends.

As this, together with every other function, is lowered during sleep, and as the plants, by the agency of light, exhale oxygen and take in carbonic acid, by which the day air is rendered more pure than that of the night, early retirement and rising are certainly conducive to health. On the same ground, too long an indulgence in bed, by interfering with the function of nutrition as well as with the process of waste, is incompatible with sound health and vigour, and ought, therefore, to be strictly avoided.

Without due observance of these and other particulars before noted, it is impossible to preserve a healthy condition of the blood ; and as this fluid is the natural stimulus and support to every organ, any declination in its quality must necessarily lead to functional inactivity, imperfect nutrition of the body,

and corresponding manifestations of mind. Hence the state of the blood and the consequent condition of the body affect the mental faculties, which by virtue of a consecutive re-action, possess an analogous influence over the frame.

To trace more particularly the influence of the mind over the body and its consequent effect on the health, it may be remarked, that there are two classes of nerves, one of which belongs to sensation, and the other to voluntary motion; and that to these correspond two orders of mental faculties, which are respectively termed the intellectual and the affective. To the former of these belong sensation, perception, thought, judgment, and imagination; whilst under the latter are classed hope, fear, love, pride, &c. All of them acknowledge an associative law, and are more or less influenced by habit. As thought is excited through the medium of the senses, it is upon these that the intellectual faculties re-act; but as the gratification of the passions and emotions takes place through the influence of the will on the voluntary muscles, it is in them that their power is displayed. Hence the body is more influenced by the passions and emotions than by thought. Imagination, however, appears to hold an intermediate place between the intellectual faculties on the one hand, and the passions on the other; and to be capable of adding originality to thought, whilst it increases the intensity of the emotions. In proportion as these are depressing or exciting, so will be the effect produced on the circulation.

Thus hope, joy, anger, &c., quicken the circulation; whilst terror, grief, &c., depress it. Notwithstanding these two opposite tendencies, their general effect on the secretions is, in most instances, to increase them—joy and grief augmenting the flow of tears—anxiety, that of the urine—and fear, that of the sweat, together with relaxation of the bowels.

Hence their injurious effects on the system. Hence also the diminished nutrition attendant on anxiety and great mental exertion, and their necessary consideration in the preservation of health.

Although our efforts may promote this, and life, for a few years, be prolonged, yet will age creep on; and with it the same organs that yesterday performed their functions energetically and vigorously; to-day are unable to accomplish the same—the eye, which in youth beamed with animation—with ardour—with perceptive intelligence, no longer concentrates into a single glance the objects of the external world; but, like the vesper sun half concealed in the western horizon, dilates with diminished energy on the passing scene—the limb, that once bore with stately grandeur the most perfect frame, or bounded with almost inconceivable agility in answer to the voice that waked the woodland echoes, or lured to festive scenes of innocent delight; weak—rigid—vacillating at every step—now unequal to its task, is at length obliged to seek the assistance of those objects which before it would have spurned—whilst the mind, that once begirt with fancy, or pursuing contemplation's track, could only find amidst the vast plenitude of

worlds poised in the immeasurable heights of boundless creation, or in the fathomless depths of wondrous reality that exist beneath the surface of our globe, themes sufficiently noble and extensive for the exercise of its powers; sinks, as it were, into mental nothingness with scarcely the ability to direct the voluntary operations of life. At length that mysterious "power which directs the atoms and controls the aggregate of nature," bursts its mortal bands, and passes like a transient dream, whilst its now spiritless tenement, no longer able to withstand the laws that govern inanimate matter, gradually returns to its kindred dust.

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